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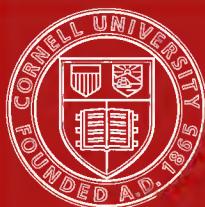
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THE
COMMERCIAL MANAGEMENT
OF
ENGINEERING WORKS.

BY
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ACCOUNTS," etc., etc.

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P R E F A C E .

A FLOOD of pessimism has been sweeping over this country for the last few years, and book and magazine and newspaper have been teaching that our trade is departing to other and more progressive countries. The statistics of "Made in Germany" have been accepted without the enquiry, which Mr. Herbert Spencer says is always so essential, into the facts which lie behind the statistics. And this pessimism has been taken advantage of by some, who are not perhaps altogether disinterested witnesses, to press upon public attention their own pet theories, or the measures which they imagine can alone remedy the present situation.

That this is no exaggeration will be conceded by any one who has read the evidence given before Lord Davey's Committee and the Lords' Committees on the Limited Liability Acts ; who has perused the reports of the Inspector-General in Bankruptcy ; or who has looked through the files of the *Accountant*. In all these pages much will be found that is suggestive and valuable ; but it is combined with many fantasies of doctrinaires.

It appeared to me that, notwithstanding the treatises of various kinds which have appeared on subjects connected with commercial management, there was room for one which would suggest to the youthful engineer the difficulties he would encounter whenever commercial duties were thrust upon him, and offer suggestions which might assist him, without dogmatically laying down any absolute rules which must be adhered to under all circumstances. Indeed, the great danger at the present time—and it is a danger arising out of the pessimism to which I have

referred—seems to be reliance on rigid system, and unthinking conformity to statutory or professional forms of accounts. The best method of financial bookkeeping, one that admits of perfect balancing, should always be adopted; but this does not debar such variations as will fit it for the business to which it relates, or the special requirements of the proprietor or manager. There is no insuperable difficulty in making these variations if the staff be properly trained. The great difference between the professional accountant and his clerks, and ordinary commercial bookkeepers is that the former are trained to think, whereas the latter are taught, and often only permitted, to slavishly follow example. Yet alike in methods of bookkeeping, in formation of cost accounts, in details of office arrangements, in management of men, and in distribution of profits, there must be such variations as will fit those methods to the peculiar circumstances of the individual firm. There must, on the one hand, be no want of system, no imperfect recording of accounts or statistics; and on the other there must be no sacrifice of the substance to the shadow: no abandonment of necessary particulars to the fanciful exigency of interlocking them with a balance-sheet. In the following pages I have honestly and to the best of my ability endeavoured to hit this happy mean, and allow sufficient elasticity for most establishments of moderate size, and for ordinary engineering undertakings. I have sought to indicate the manner in which the clerical staff may be made to render valuable services to their employers, without encroaching upon the work of the technical officers, or assuming duties and authority for which they are not qualified, either by education or training. The book is for the youthful engineer, the student and junior foreman; the general manager who has fought his way to the topmost rung of the ladder will have already formed his own system and stereotyped his own ideas: his very personal success will be his warranty for them.

I take this opportunity of acknowledging my indebtedness to two members of the Institute of Chartered Accountants, Mr. Alfred Shuttleworth and Mr. John Wilson, both of Manchester, for the many suggestions they have made to me during the progress of the work, for perusal of some of the more difficult accountancy problems, and, above all, for the kindly encouragement they have extended to me at times when I was labouring under personal difficulties and depression. Had it not been for their sympathetic countenance this handbook, whether it be good or whether it be ill, would probably never have been completed.

FRANCIS G. BURTON.

MANCHESTER,

10th December, 1898.

CONTENTS.

	PAGE
CHAPTER I.—THE DIRECTORS AND SECRETARY	1
Introductory — Commercial Management — Directors' Duties and Responsibilities—Signing of Documents—Seal of the Company—Rules for Meetings—Officers' Attendance—Appointment of Officers—Secretary and his Duties—Books and Forms, &c.	
CHAPTER II.—THE AUDITOR	16
Qualifications—Preparation of Balance Sheet—Examination of Books and Accounts—Not Qualified for Management—Summary of Duties—Monthly Audits.	
CHAPTER III.—THE GENERAL MANAGER	20
Duties and Qualities of the Manager—Capacity for Justice—Discipline—Routine Duties—Selection of Staff—Qualifications as Engineer—Interviews.	
CHAPTER IV.—THE DRAUGHTSMAN AND SUBORDINATE OFFICIALS—REQUISITIONS FOR MATERIALS	26
Subordinate Officials—Drawing Office—Scientific Investigations—Purchases and Sales—Drawing Office Requisitions—Storekeeper's Requisitions—Passing of Stores Requisitions.	
CHAPTER V. — PURCHASES AND INSPECTION OF MATERIALS	32
Forms of Order—Placing of Order—With Favoured Firm—The Cheapest Market—Record of Catalogues and Tenders—The Card System—Illicit Commissions—Date of Delivery — Penalty Clause — Inspection of Materials in Progress.	

	PAGE
CHAPTER VI.—RECEIPT OF MATERIALS AND PASSING OF INVOICES, &c.	39
<p>Receipt of Materials at Works—Receipt by Storekeeper— The Storekeeper—Delivery Notes—Test of Materials— Invoices—Examination in Office—Passing for Pay- ment—Correction of Invoices—Returns and Rejections— Debit and Credit Notes—Packages and Discounts— Invoice Book—Posting of Invoices—Stores Ledger— Invoices not Rendered—Payment of Accounts—The Accountant—The Cashier—Monthly List of Creditors— Sanction by Directors and Drawing of Cheques—Form of Cheque—Vouchers—Petty Cash.</p>	
CHAPTER VII.—COST ACCOUNTS—RECAPITULATION OF ARRANGEMENTS FOR PURCHASES	67
<p>Cost Accounts—Nature—Division—Invoice Debits to Cost Accounts—Freight and Cartage—Temporary and Branch Establishments—Recapitulation.</p>	
CHAPTER VIII.—SALES DEPARTMENT	79
<p>Sales Department—Advertising—Catalogues—Travellers —Collection of Accounts by Travellers—Daily Reports— Personal Solicitation—Reputation of the Firm—Division of Sales.</p>	
CHAPTER IX.—THE CORRESPONDENT AND HIS DUTIES.	87
<p>The Correspondent—His Authority—Registration of Letters—Distribution of Letters—Departmental Letters— Telegrams—The Typewriter—Lady Clerks—Register of Addresses—Printed Memorandums—Postal and Telegram Register—Filing Letters—Quotations by Standard Prices.</p>	
CHAPTER X.—THE PREPARATION OF ESTIMATES.	98
<p>Nomenclature of Machine Details—Estimate Clerk—Cata- logue Estimates—Average Cost of Materials—Weight of Materials—Establishment Charges—Profits on Standard Machines—Estimates in General—Data for Estimates— Order of Estimate—Labour and Materials—Quantities of Materials—Approximations from former Constructions— Boiler Specification.</p>	

CHAPTER XI. — PREPARATION OF ESTIMATES (*continued*)—TENDERS SENT OUT—ORDERS RECEIVED. PAGE 113

Price of Materials—Unstable Equilibrium—Estimation of Labour — By Technical Experts — Cost Accounts—Foremen's Records — Steamship Estimate — Establishment Charges—Profit—Estimates sent to Customers—Tender Copybook—Pursuing Tenders—Tender Index-book—Estimates and Commercial Records—Orders Received and Register—Recapitulation.

CHAPTER XII.—DRAWING OFFICE ORDERS FOR WORK—STOCK ORDERS 132

Drawing Office Orders for Work—Stock Orders—Drawing Office Order Book—Shop Orders and Lists—Form—Name Plates—Shop Drawings—Parts to be Supplied—Patterns Required—Supplementary Shop Orders—Drawing Register—Drawing Numbers—Pattern Numbers—Form of Register.

CHAPTER XIII.—ALTERNATIVE PLAN OF REGISTER—ALTERATION OF DRAWINGS AND PATTERNS—FILING DRAWINGS 148

Alternative Plan of Register—Shop Drawing Numbers—Pattern Numbers—Weights—Index to Register—Special Contract Drawings—Alteration of Drawings—Alteration of Special Contract Drawings—Alteration of Standard Drawings — Alterations of Patterns — Drawings for Works—Preparations of Shop Drawings—Separate Drawings—Examination—Return of Tracings and Prints—Temporary Sketches—Tracings sent Away—Shop Drawings Diary.—Filing Drawings—Sketch Books, &c.

CHAPTER XIV.—THE WORKS MANAGER AND HIS DUTIES—DEALINGS WITH WORKPEOPLE . . . 163

The Works Manager—Relations with Drawing Office—Workmen and Factory Rules—Works Manager's Order Book—Clerk—Conferences—Shop Appointments—Workmen's Characters—Attainment of Character—Incentives to Productive Energy—Profit Sharing—American Methods—Fixed Piecework Rates—Analytical Piecework Rates—Differential Piecework Rates—Effects of Automatic Grading of Men—Quick Returns Essential—Piecework Prices not Cost Accounts—Contract System.

	PAGE
CHAPTER XV.—WAGES ACCOUNTS—ISSUE OF MATERIALS—STORES BOOKS AND RETURNS	180
<p>Timekeeping—Time of Staff and Foremen—Admission of Workpeople—Time Checks—Check Boxes—Rough Time Book—Time Tickets—Wages Book—Abstract of Wages—Checking of Wages Book—Piecework—Checking Rates—Checking Time—Payment of Wages—Disputes as to Wages—Payment of Absentees—Unpaid Wages—Issue of Materials—Removal of Materials from Stores—Determination of Relative Transport Costs—Collection of Materials—Stores Issue Book—Posting of Stores Issued—Return of Stores Issued for Accountant—Posting of Stores Issues in Financial Ledger.</p>	
CHAPTER XVI. — COST ACCOUNTS—DEPRECIATION. INTEREST—ESTABLISHMENT CHARGES	208
<p>Necessity of Detailed Cost Accounts—Cost Sheet A—Management Expenses, Form A—Debits to Account—Credits to Account—Direct Charges for Special Purposes—Cartage, Coal, and other Establishment Charges—Depreciation—Depreciation by Individual Machines—Interest—Later Departmental Sheets—Sheet A—Transfers from Departments—Estimated Charges—Credit Transfers to Sheets—Materials and Expenses—Salaries and Wages.</p>	
CHAPTER XVII.—COST ACCOUNTS (<i>continued</i>).	230
<p>Sheet B, Form of—Scrap Material—Balance of B Sheets—C or Contract Summary Sheet—Arrangement of Debits—Credits—Closing of C Accounts—Quantities in C Account—Trade Debits and Credits—Transfers to Plant Sheets—Recapitulation.</p>	
CHAPTER XVIII.—MONTHLY PROFIT AND LOSS ACCOUNT—CLAIMS—LOOSE TOOLS	245
<p>Monthly Profit and Loss Account—Works Instruction Book—Shop to Shop Orders—Claims Against Railway Companies, &c.—Form of Claims Book—Loose Tools—Electrically-driven Tools—Schedule of Loose Tools—Goods <i>en Bloc</i>.</p>	

	PAGE
CHAPTER XIX.—GOODS MANUFACTURED FOR STORES AND WAREHOUSE—TRAVELLERS' AND SPECIAL EXPENSES	257

Goods Manufactured for Stores—Form of Order—Alternative Form of Order—Goods Manufactured for Warehouse—Requisitions from Warehouse—Orders for Warehouse Goods—Stocks in Stores and Warehouse—Warehouse Book—Charges to Warehouse—Warehouse Accounts—Travellers and Catalogues—Charges in Advance of Orders—Charges in Advance on Foreign or Public Contracts.

CHAPTER XX.—SALES IN COMMERCIAL BOOKS— REPORTS TO BOARD—DIAGRAMS	272
---	-----

Instructions to Warehouseman—Delivery Book—Marking Packages—Advice of Deliveries by Warehouseman—Invoices to Customers—Copies of Invoices—Day Book—Monthly Statements—Monthly Reports to Board—Diagram Accounts—Diagram of Cost Accounts—Technical Diagrams—Custody of Diagrams.

CHAPTER XXI.—STOCKTAKING—BRANCH HOUSES— CUSTOMS AND SHIPPING REGULATIONS—RESERVE FUNDS.	286
---	-----

Stocktaking—Branch Houses—Foreign Houses—Foreign Cost Accounts—Customs Regulations—Shipping Regulations—Reserve Funds—Investment of Reserve Funds—Recapitulation—Conclusion.

CHAPTER I.

THE DIRECTORS AND SECRETARY.

Introductory.—So many treatises have been issued of late years, by all sorts and conditions of men, instructing manufacturers and merchants on the best and most economical conduct of their business, that an additional homily may appear superfluous. The story of the old man and his ass is the fabulists' warning against the hasty adoption of every passing device recommended by the latest empiric; but another eminently wise man assures us that "in the multitude of counsellors there is safety." There is no real antagonism between the fable and the proverb, though there may appear to be some at first sight. The old man lost his ass, not because of the volume of advice poured upon him, but because he did not use his brains to sift it, and consistently to follow that which he found good. We therefore venture to enter on our self-appointed rôle of commercial experts without any misgivings as to our ability to render valuable services in that character, but with the distinct warning to our readers that if they fail to profit thereby the fault will be theirs, not ours; they must themselves sift the chaff from the wheat; they must form their own judgments as to which of our suggestions are useful, and which superfluous, unpractical, or prejudicial.

Commercial Management.—The term "Commercial Management" is a very comprehensive one, and includes a great deal more than making office arrangements, compiling catalogues, purchasing stores, and selling products. It cannot be understood without taking cognizance of tact and temper, of character and dispositions of workpeople, of situation of works, of facilities of transit and possibility of extending railway and canal connections, as well as filing of letters and making out invoices. It has its *content* in a profitable workshop, and therefore includes everything which affects the profit and loss account, whether it

be initially of a technical or commercial character. It is supreme over technic, in so far as the employment thereof is concerned; no science, no ability, can be justified in a workshop where ruin would follow on its use; it is subordinate to technic, because no commercial management can in these days be successful which is purely empiric in character, and neglectful of scientific deduction and knowledge. The problem presented is a very wide one, and requires in its solver broad and extensive observation of men as well as books, as well as the possession of personal qualifications which may be indicated but cannot be imparted.

Value of System.—System there must be, and proper subordination of persons and authority; but, while it is possible to indicate a system, and suggest the gradations of officials, it must always be remembered that no cast-iron regulations should be pedantically adhered to without careful consideration of their suitability to the particular case in point. If disorder is Charybdis, rigidity is equally Scylla. The true course is the middle one—the equal steerage which avoids both rocks. If the Bankruptcy Court too frequently records failures accelerated, if not induced, by indifferent bookkeeping, the Admiralty, Ordnance, and other Government departments exhibit the dangers of an apotheosis of clerkism, and the baneful results arising from the paramount influence of an office establishment. After all it is a new form of the old, old problem of the workman and his tools. It is the man behind the gun, quite as often as the character of the gun, which decides the battle.

Directors' Duties and Responsibilities.—Most of the large, and many of the small, engineering undertakings of the country are now incorporated as limited liability companies; those which are not now so incorporated must become so under the stress of modern legislation. It is, therefore, convenient to regard the management from a company point of view, merely premising that the same system of management will apply to a private concern, the proprietors being in such case substituted for the directors, and exercising the authority and powers usually undertaken by the latter. It is hardly necessary to inquire into the distinction between private and public companies: a very able parliamentary committee has been unable to define it, and the law at present affords little more latitude to the directors of the one kind than to those of the other.

Both are regarded as agents for the company.—indeed, by a kind of legal metaphor, as trustees—and they are subject, therefore, to many of the obligations of an agent to his principal. In the case of *Parker v. McKenna* (10 Ch. 96) the directors were compelled to refund profits made by them on certain dealings with a new issue of shares of the bank. Lord Justice Cairns, in delivering judgment, said: “Now the rule, as I understand it, as to agents is not a technical or arbitrary rule. It is a rule founded on the highest and truest principles of morality. No man can, in this court, acting as an agent, be allowed to put himself into a position in which his interest and his duty will be in conflict.” Lord Justice James, in concurring, said: “I do not think it is necessary, but it appears to me very important, that we should concur in laying down again and again the general principle that in this court no agent, in the course of his agency, in the matter of his agency, can be allowed to make any profit without the knowledge and consent of his principal; that this rule is an inflexible rule, and must be applied inexorably by this court, which is not entitled, in my judgment, to receive evidence, or suggestion, or argument, as to whether the principal did or did not suffer any injury in fact by reason of the dealing of the agent; for the safety of mankind requires that no agent shall be able to put his principal to the danger of such an inquiry as that.”

Particular Agents.—But the directors of a company are not only agents, they are also particular agents; that is, they can only exercise the powers delegated to them, and in the manner prescribed by law, and can only exercise such powers as are within the scope of the company's business and sanctioned by its memorandum of association. Lord Cairns, in one of his judgments (*Ashbury, &c., Co. v. Riche*, L.R. 7, H.L. 653), remarked: “With regard, therefore, to the memorandum of association, if you find anything which goes beyond that memorandum, or is not warranted by it, the question will arise whether that which is done is *ultra vires*, not only of the directors of the company, but of the company itself. With regard to the articles of association, if you find anything which, still keeping within the memorandum of association, is a violation of the articles of association, or in excess of them, the question will arise whether there is anything more than an act *extra vires* the directors but *intra vires* the company.”

Sir Henry (now Lord) Thring, in his treatise on company law, advises that any person dealing with a corporation must, to ensure safety, be satisfied of the following points:—

1st—That the contract is within the scope of the company's powers ;

2nd—That the directors, or other agents engaged in making the contract, are duly authorised by the company ; and

Lastly—That the contract is under the seal of the company, or in such form as may be prescribed by Act of Parliament ; or, if not, that the company is a trading corporation, and the contract relating to matters incident to the purposes for which the corporation was created.

Limitations by Memorandum and Articles of Association.—It will readily be seen that the office of director involves duties and responsibilities which must be rigidly discharged if the director is to save himself from legal entanglements. It is absolutely necessary for his own protection, as well as that of his company, that he should make himself thoroughly acquainted with the nature and character of the business sanctioned by the memorandum and articles of association. It is hardly to be supposed that a company promoted for building an Eiffel tower will indulge in shrimping operations ; such a gross violation of its character is not to be anticipated, and yet it would not legally be more wrong than for a carrying or tramway company to sell coals, when it had not taken powers to do so in its memorandum of association. It will also be seen that acts which may not be *ultra vires* the company, may yet be beyond the powers delegated to the directors, and may involve them in serious personal liability.

Payment of Dividends out of Revenue or Capital.—The right of a shareholder to dividends is governed by the regulations of the company, and by any stipulations incident to the issue of the shares ; but one universal rule applies, that dividends shall be paid only out of profits, that is, out of the excess of ordinary receipts over expenses properly chargeable to revenue account. If directors order the payment of a dividend when no profits have been made, and without expressly saying that they are paying it without having earned it, a gross fraud is practised, “and the directors are not only liable to those whom they have

deceived and injured, but are guilty of a conspiracy, for which they are liable to be prosecuted and punished.” If a fraudulent and delusive balance sheet is prepared by their authority, and dividends paid thereunder, they will be compelled by the High Court to refund the amount of dividends they have themselves received; indeed, directors who have paid dividends out of capital have been ordered to replace the amount of all the dividends so paid, together with interest thereon, but without prejudice to their right of recovery from the shareholders. (See Rance’s case, Stringer’s case, and *Evans v. Coventry*). The tendency of judicial dicta and of modern legislation is to increase rather than diminish the responsibility of directors in all matters connected with the management of the company, whether expressly done or only permitted by them.

Directors Act as a Board.—Directors can act only as a board or in exercise of powers specially delegated by the board, and the execution of which they should report thereto. When they act on their own initiative, without the sanction or subsequent ratification of the board duly recorded in the minutes, they may incur serious personal responsibility. The dictum of Lord Cairns on *extra vires* and *intra vires* should be remembered, with the consequences which may follow thereon. It is in many, and more particularly in private, companies usual to appoint one or more members of the board as managing director or directors. In such cases the authority delegated to the managing director should be clearly set forth in the minute or deed appointing him. It sometimes happens that the managing director is also manager of the company, discharging all the duties of that officer, and taking a very intimate share in the management of the place. There is here a combination of two distinct offices, and great care is sometimes necessary to avoid legal complications in consequence. One safeguard, which should not be neglected, consists in exhaustive reports to the board, as full and complete as if the transactions were directed by an officer not having a seat thereat.

Signing of Documents and Contracts.—Care should be exercised in the manner of signing important documents, so as to distinctly signify that they are only signed on behalf of the company. In accepting a bill of exchange, addressed to the Clydesdale Engineering Company Limited, it is not sufficient to add after the signatures the words

“Directors,” or “Directors of the Clydesdale Engineering Company Limited.” Such wording has been held to be merely descriptive, and not to exclude the personal liability of the signatories in the event of the company not meeting the bill in due course. The correct wording would be:—

Accepted. Payable at the
Union Bank of London Limited,
Chancery Lane,
London.

For and on behalf of
The Clydesdale Engineering Co. Limited.

A.B., }
C.D., } Directors.

G.H., Secretary.

Or the following form may be adopted ; it is the usual one with some companies :—

Accepted.

For The Clydesdale Engineering Company
Limited, and by its authority : payable at the
Union Bank of London Limited, Chancery
Lane, London.

A.B., }
C.D., } Directors.

G.H., Secretary.

The same form of words (For, &c.—or, For and on behalf of, &c.) should be adopted for all important documents not under seal, when there is no provision in the body thereof barring any personal liability on the part of the directors, or expressly declaring that they act only as agents of the company. Many companies adopt a hand stamp for this purpose, and also for correspondence signed by their directors, agents, or managers, and the use of such a stamp is very desirable for letters and documents of importance, or which may possibly lead up to a contract.

Seal of the Company.—Closely connected with the matter of signatures is the seal of the company, a remnant of mediæval want of scholarship which may be regarded as the signature of the corporation. It must be used in strict accordance with any rules made by the company or

the board of directors limiting or regulating its use. Usually the seal is confirmed by an attestation clause, thus:—

The seal of the company was
affixed hereto in the presence
of



A.B., }
C.D., } Directors.

Countersigned, G.H., Secretary.

The safe custody of it, and security from improper or unauthorised use, is a matter of great importance, and in most companies the official seal is provided with three distinct locks, with separate keys (not interchangeable), which keys are in the several custody of two of the directors and the secretary. The seal itself is kept in the secretary's safe, but cannot be used without the three custodians of the keys being present. The exchange of these keys from one director to another should be effected in a formal manner, and recorded in the board minutes, otherwise some unpleasant complications may ensue. We remember a case where an endeavour was made to render a director liable on some debentures sealed during his absence in Japan, on the ground that he was one of the key directors, and had not returned his key to the board before his departure, but had handed it privately to a brother director.

Rules for Directors' Meetings. — As we before remarked, the directors act as a board, and it is desirable that they should adopt a code of rules for their proceedings, and record these rules in the minutes of one of the earliest board meetings. It is also advisable to fix a quorum, so as to avoid the necessity of requiring all the directors to concur in the transaction of business. The following regulations, suggested by Francis B. Palmer, Esq., of the Inner Temple, barrister-at-law, are of a very simple but useful character:—

1. A board meeting shall be held every —— day at —— o'clock. Such meetings shall be called ordinary board meetings. Other meetings shall be called special.
2. Every ordinary meeting shall be held at the registered office of the company. Special meetings shall

be held at such time and place as may be determined by the chairman.

3. An ordinary meeting shall be competent to transact the following business, namely: To ——— &c., &c. All other business shall be transacted at a special meeting.

(NOTE: The business to be transacted at an ordinary meeting should be very fully expressed, so as to include all the ordinary affairs of the company, the purchasing of materials, the regulation of wages, the consideration of estimates and tenders, and the acceptance of ordinary trade contracts.)

4. Any director may, and upon the requisition of any director the secretary shall, convene a special meeting; not less than ——— hours' notice shall be given thereof to each director. Every such notice shall state the time and place fixed for the meeting, and the business to be brought forward for consideration thereat.
5. The quorum of an ordinary meeting shall be two directors, and of a special three directors.
6. No cheque for more than £—— shall be signed at a meeting unless ——— directors are present.
7. The common seal shall not be affixed to any document except in pursuance of a resolution of the board, and the sealing shall be attested by two directors, and countersigned by the secretary.
8. A meeting at which not less than ——— directors are present may suspend, rescind, or modify these directions.

The routine of proceedings at the board meetings is as follows: The chairman of the company, if there is one, takes the chair; in his absence this is taken by the deputy-chairman, or by one of the other directors elected by his colleagues then present. The secretary reads the minutes of the previous meeting, which, if approved as correct, are signed by the present chairman. Some directors invariably add the date of signing, and this is a good and safe practice, which, in certain emergencies, may prove of the utmost value. No discussion should be permitted as to the policy of the proceedings recorded; the minutes are simply submitted for approval as a correct record of what has already transpired, and unless their accuracy is impeached they

should be passed and signed without comment. If, however, any director objects to the policy expressed therein, he can, *after the minutes have been signed*, move a resolution in reference to it; as, for instance, that the resolution of the previous meeting be cancelled, and the matter be further considered by the board at a special meeting to be held ———; or that it be referred back to the manager for further report.

The chairman will then call attention to the various items of business, taking them seriatim as they appear on the agenda. It is well to provide each director with an agenda paper, but the chairman and secretary should be provided with agenda books, the left-hand side of which contains the heads of the business to be transacted, with sufficient space left between each item, whilst the right-hand side is used for taking those notes from which the minutes are subsequently prepared. Resolutions of any importance should be drafted and submitted to the meeting at the time in the exact wording intended for the minutes, so as to avoid any subsequent disputes as to the decisions actually come to.

Directors' Committees.—Where a board is large and unmanageable, or where the business requires daily attention from some of the directors, but not necessarily from all, it will be found convenient to appoint a committee or committees for such detail work, subject to regular and full reports of their proceedings being made to the board. Minutes of proceedings of such committees should be kept exactly in the same manner as those of the board, and the procedure of the latter will be found generally applicable to its sectional committees.

Officers' Attendance at Boards and Committees.—It is extremely desirable that heads of departments should be present at all board and committee meetings at which their duties are to be reviewed, but considerable discretion must be exercised in calling them into the boardroom. The secretary will usually be present during the whole of the meeting, and the manager also, unless requested to withdraw for a time whilst the directors are considering some complaint specially directed against him, or debating some point of discipline wherein he is interested as one of the parties. It would be both foolish and unjust to consider such points as these without hearing all he has to say, and listening to any explanations he may have to

make ; in general, it would be unwise to take any measures which might degrade his authority, or even temporarily to appear to doubt his ability, but it may sometimes be desirable to debate his conduct in his absence, and he must then be requested to temporarily withdraw. On the other hand, it would be absurd to have the accountant seated at the table during a long discussion on the provision of increased motive power, or whilst a determination was being arrived at on the merits of a quarrel between the master smith and the mould loft draughtsman ; nor would the efficiency of the office staff be promoted by the chief draughtsman or works manager being present during the time the accountant was receiving a reprimand for a seeming omission in a complex series of accounts, or was endeavouring to explain the succession of entries by which he had sought to make some particular transaction intelligible in the books. These subordinate officials should all have right of access to their directors ; they should all be present when their conduct or work was under review by either committee or board ; but they should only be in the room when, either in justice to themselves, or for the benefit of the company, their presence is desirable ; during the rest of the time they will be much better employed at their ordinary duties.

Directors' Attendance Book.—A directors' attendance book should be kept, which must be signed by each director as he enters, or at all events before he leaves the room. A page or half a page can be devoted to each meeting, according to the number constituting the board. Each should be headed showing whether it is a committee or board meeting, the place at which it is held, and the date, and ruled for signatures. In some companies it is usual for this book to be signed by the officers present, as well as by the directors. In such case a red ink line should be drawn under the directors' signatures, and those of the officers placed beneath it.

Appointment of Officers.—One of the most important duties devolving on the board is the appointment of officers, as on the wisdom displayed in the selection of these assistants will largely depend the prosperity of the company. The officer most immediately and closely brought into contact with the directors and shareholders is the secretary, and although he cannot well be termed the principal official, his duties are of such importance as

to make his selection a matter of some moment. The exact authority and precedence granted to him vary considerably, and the tendency of late years has been to diminish them by transfer of all executive authority to the technical manager. Time was when Mr. Saunders, the secretary, was styled, and truly styled, "Mr. Great Western," but it would be difficult to find an instance of the kind at the present time.

The Secretary and his Duties.—He is the official mouthpiece of the board of directors, and usually replies to communications immediately addressed to the board. He must attend all meetings of the company, and of the directors; take proper minutes of the proceedings, and write them up in the minute books for permanent record. He will issue all notices to members and others relating to meetings, or to arrangements affecting capital or dividends; he will conduct all correspondence with shareholders in regard to calls, transfer or forfeiture of shares, and re-arrangements or consolidation of shares, stocks, or debentures. Certain of the company's books should always be kept by him, or under his immediate and personal direction; viz.:—

1. The Register of Members.
2. The Share Ledger.
3. The Numerical Register of Members.
4. The Certificate Book. This contains forms of certificates of title, and the particulars of each certificate issued must be entered on the counterfoil.
5. Register of Transfers.
6. Minute Book of General Meetings.
7. Directors' Minute Book.
8. Register of Mortgages.

It is essential that the secretary should have some acquaintance with joint-stock company law, sufficient at least to ensure that the statutory regulations will not be neglected through sheer ignorance. One or two of these requirements demand special attention. By section 25 of the Companies Act, 1862 (25 and 26 Vict., c. 89), it is enacted:—

Register of Members.—"Every company under this Act shall cause to be kept in one or more books a register of its members, and there shall be entered therein the following particulars:—

- (1) The names and addresses and the occupations, if any, of the members of the company, with the addition, in the case of a company having a capital divided into shares, of a statement of the shares held by each member, distinguishing each share by its number; and of the amount paid or agreed to be considered as paid on the shares of each member;
- (2) The date at which the name of any person was entered in the register as a member;
- (3) The date at which any person ceased to be a member.

And any company acting in contravention of this section shall incur a penalty not exceeding five pounds for every day during which its default in complying with the provisions of this section continues, and every director or manager of the company, who shall knowingly or wilfully authorise or permit such contravention, shall incur the like penalty."

Annual List of Members.—The following section (the 26th) contains directions for an annual list of members to be filed with the Registrar of Joint-stock Companies twenty-one days after the date of the first general meeting in each year, the penalty for neglect being similar in character and amount to that for the non-keeping of the register.

By section 32 of the Act of 1862, this register of members is required, under a penalty, to be kept at the registered office of the company, and during business hours (but subject to such reasonable restrictions as the company in general meeting may impose, so that not less than two hours in each day be appointed for inspection) to be open to the inspection of any member gratis, and to any other person on payment of one shilling. The company shall, if required, supply any such member or other person with a copy of the whole or any portion of the register on payment of sixpence for every hundred words copied.

Official Notices.—In addition to the annual returns the following notices may have to be forwarded to the registrar at various times during the history of the company:—

1. Notice of situation of registered office.
2. Notice of change of office.
3. A *printed* copy of every special resolution.
4. Notice of increase of capital.

5. Notice of conversion of shares into stock.
6. Notice of consolidation of shares.
7. Copy of order of court, and minute on reduction of capital.
8. Consent of Board of Trade to change of name.
9. Letter requesting registrar to issue certificate on change of name.
10. Notice of ratification of register by the court.
11. Copy winding-up order.
12. Final order for dissolution.
13. Liquidator's final return.
14. His consent to the registration of new company by same name.

The notices from 10 to 14 inclusive will, however, seldom be required from the secretary, unless he be also appointed liquidator.

Minutes of Meetings.—The minutes should clearly and distinctly record the proceedings at meetings and the resolutions passed by the directors or shareholders. Resolutions of special importance are usually drafted by the company's solicitor, and his wording should be implicitly followed. Resolutions proposed by a shareholder, whether adverse to the board or supporting their policy, should always be written out by the proposer, and the chairman should insist upon this being done before submitting them to the meeting; the exact wording must be followed in the minutes. The ordinary resolutions of the board of directors, or of committees of the board, will be merely noted on the agenda paper or agenda book (a book is preferable), and the secretary will have to record these in the minutes in fitting language. He should remember that it is most fitting when as concise as is compatible with clearness: company minutes are not exercise books for amateur eloquence. The following will be useful examples of records of the exercise of the directors' powers:—

A call is made by passing a resolution:

“That a call of £—— per share be and the same is hereby made on the members of the company, such call to be payable on, &c., at, &c.”

A resolution for forfeiture may be:

“That the shares numbered, &c., of A.B. be and the same are hereby forfeited.”

This, however, is one of the cases in which the solicitor of the company should be consulted, and should draft the minute.

Resolutions to appoint a committee may be in one of the following forms :

"That Messrs. ——— and ——— be and they are hereby appointed a committee, with power on behalf of the company, &c., &c."

"That Mr. ——— be and he is hereby appointed a committee for the purpose, &c.; and that the following powers and authorities be delegated to him. (1) power to, &c; (2) power to, &c."

"That Messrs. ——— and ——— be and they are hereby appointed a committee for the purpose of settling with Mr. ——— the terms of an agreement for, &c.; and that they be and they are hereby authorised to execute, on behalf of the company, an agreement in writing embodying such terms."

With reference to contracts the resolutions may be :

"That the seal of the company be affixed to a contract dated ——— between, &c."

"That the offer of Evans, Drury, and Company Limited to supply the company with ——— be and the same is hereby accepted, and that the secretary do give Evans, Drury, and Company Limited notice of this resolution."

It must be remembered that one matter may, before it is finally concluded, come before the board several times. Thus, when a resolution has been passed to borrow money, it will be necessary to either issue a prospectus or apply to some person or persons to lend it on security offered. The prospectus, when prepared, should be submitted to the board, and a resolution passed approving of it, and in some cases it is advisable to so submit and obtain sanction to the letter applying for the loan. Again, when the lender has been obtained, and the security and terms mutually agreed upon, it will be necessary for the directors to pass a resolution approving thereof, and directing the common seal to be affixed to the contract. Afterwards, when the seal is affixed and witnessed by two directors, it is necessary that this fact be properly recorded in the minutes.

Reports on Directors' Resolutions.—It is the duty of the secretary to ascertain that the resolutions and

instructions of the directors are carried into effect by the proper officers, and to see that those officers make reports of their attention to the next succeeding board meeting. The carrying out of this duty demands considerable tact, so as to avoid clashing with the manager, for whilst the secretary is both mouthpiece and eyes and ears of the board, he is not the executive officer charged with the carrying of their resolutions into effect. Nor is he usually qualified to do so. It is by no means necessary that he should be fitted for engineering work in order to discharge his office; indeed, the resources demanded of him are too frequently neglected by some engineers; but it is absolutely necessary that he should be endowed with tact, patience, memory, common sense, and unfailing good temper.

CHAPTER II.

THE AUDITOR.

Qualifications of the Auditor.—Perhaps the consideration of the auditor ought to be deferred to a later period. His duties commence where those of the other officials end, and the proper place for him would therefore appear to be the last chapter in the book. But, on the other hand, he is an officer (the Courts have now decided that he is an officer of the company) of supreme importance, and his influence pervades every part of the clerical organisation. So much depends on his personal character that it is impossible to exercise too great care in the selection of him. In a report by the Council of Associated Stock Exchanges to a Departmental Committee appointed by the Board of Trade a useful suggestion is made. It has been tried for many years past, in a slightly modified form, on the London and North-Western and other railways, and has been found to work admirably. It is: "We also recommend (1) the statutory institution of audit committees, consisting of shareholders, who should have power to appoint a professional auditor and fix his remuneration; and (2) that any adverse report by the auditor should be sent to the shareholders with his certification of the accounts, or in lieu of his certification, if such has not been given." The practice of appointing audit committees is not general, and may possibly require some modification of the articles of association, which are usually modelled on Table A of the Act of 1862, and state that: "Once at least in every year the accounts of the company shall be examined, and the correctness of the balance sheet ascertained by one or more auditor or auditors." This Table A requires that the election of auditors shall be made by the company at their ordinary meeting in each year; that they may be members of the company, but that no person shall be eligible for the position who is interested otherwise than as a member in any transaction of the company; and that no director or other officer of the company shall be eligible during his continuance in office.

Preparation of Balance Sheet.—The table directs that: "Every auditor shall be supplied with a copy of the balance sheet, and it shall be his duty to examine the same, with the accounts and vouchers relating thereto." It has, however, become quite usual in small companies, and even in some of the more important corporations, for the auditor to prepare the balance sheet himself, and afterwards examine, vouch, and certify to the correctness of that which is, practically, his own work.

Examination of Books and Accounts.—The auditor is to have delivered to him a list "of all books kept by the company," and at all reasonable times to have access to the books and accounts of the company, and he may, in relation to such accounts, examine the directors or any other officer of the company. He is also to state in his report to the shareholders (if the regulations of Table A are adopted) whether, in his opinion, the balance-sheet is a full and fair balance-sheet, properly drawn up so as to exhibit a true and correct view of the state of the company's affairs; and also, in case he has called for information or explanation from the directors, whether they have been given by the directors, and whether they are satisfactory.

Auditor not Qualified for Management.—The office of auditor is thus a most important one, demanding not merely knowledge and skill, but also unwavering honesty, and sometimes considerable courage. The auditor must be independent, proof against undue influence (which, however, is never attempted in respectable and stable companies), and also free from any participation in the management. This is recognised by the Legislature in the model articles of association, Table A, attached to the Act of 1862, which says that although he may be a member of the company, he must not be interested otherwise than as a member in any of its transactions, nor shall he be eligible as auditor during his continuance in office as a director or other officer of the company. But there is a deeper reason for dissociation of the auditor from managerial functions than any clause in an Act of Parliament. The office of the auditor is critical; his work is to protect the shareholders and the public by reviewing the acts of the managers, and detecting and pointing out their errors and irregularities, not by superseding them in executive duties. It is a defect inherent in human nature to look kindly on our own suggestions and on our own

work, and from this defect accountants are no more free than other men. To them, as to the whole race, the old adage applies—every grey goose thinks her goslings swans. As thought, conception, advice precede and control action, it is almost impossible for an auditor to adversely report on any policy which has been undertaken in compliance with his suggestions, or to condemn expenditure, contracts, or financial operations he has himself recommended.

Limits of Auditor's Knowledge of Business.—But there is a further consideration, arising out of actual practice, which tends to render the interference of an auditor in the management of a company extremely undesirable, if not actually mischievous. To the Departmental Committee already referred to, several of the Chambers of Commerce have recommended that auditors should be public accountants—chartered or incorporated. There is certainly a growing tendency at the present time to appoint public accountants to that office. Whether or not the London and North-Western system of an audit committee of shareholders is a better one, assisted if needful by a professional accountant, it is unnecessary to inquire; it is not suitable for any but large companies with a long roll of shareholders, and even then the professional accountant has a great advantage over the ordinary shareholder in his extensive acquaintance with various forms of account. Yet his knowledge of any business he audits is necessarily of a very limited nature if his practice is a large one. This is evidenced by a clause in a memorandum by Mr. Frederick Whinney, of Messrs. Whinney, Smith, and Whinney, one of the most reputable firms of chartered accountants in the city of London. It reads: "That it is desirable and necessary, especially for large companies, that auditors should be skilled accountants, with staffs of trained clerks, and that it should be recognised that it is impossible for an auditor to supervise all the details of every business." Translated into ordinary every-day English, and explained by the usual practice of eminent and successful accountants, this means that the auditor shall be expected to deal personally with the accounts only in their final forms of revenue account, profit and loss account and balance sheet, and base his report on the figures he finds therein, and on the information he can cull from more or less expert clerks, who have examined and ticked the books. This may be,

and, assisted by his specialised accountancy training, probably is, sufficient for general critical purposes; but it certainly will not render him a desirable or safe guide in the commercial arrangements of the company, or the general direction of its policy.

Summary of Duties.—The auditor, then, is one of the most important, if not the most important functionary of the company; exploring, either personally or through his clerks, the records of all its transactions, and reporting to the shareholders whether they are properly presented or not. He reviews the transactions of the directors equally with those of the meanest official; he is entitled to require from the directors and officers such information and explanations as may be necessary for the performance of his duties; and if these are not forthcoming, he can report the laches to the shareholders. His powers, within the limits of his office, are absolutely draconic, and we must confess that they are generally used wisely, and for the advantage of his clients. When he fails it is usually through the directors imposing upon him, or his vanity or covetousness inducing him to assume duties which are inconsistent with his critical functions; such as rendering active assistance in executive details, or recommending for adoption his own pet theories of trade management or manufacture.

Monthly Audits.—It is well to arrange, whenever it can possibly be done, for a monthly or continuous audit. In a thorough audit (and these will, in future, be the rule rather than the exception) it is necessary that every entry in the ledger, journal, cash book, and purchase and sales books, together with those of any important subsidiary book, should be compared and ticked, vouchers examined, and all additions checked. This takes up considerable time, especially in large establishments, and, if it is all left to stocktaking, may seriously interfere with the legitimate work of the office. A considerable portion of this routine and detail work may, however, be done month by month, and the inconvenience of the audit will not then be felt so much at balancing time. There is a further advantage in a continuous audit causing a speedy detection of errors; they are thus frequently discovered before they cause unhappy complications, whilst merely clerical errors, or inaccurate and improper postings, are most easily corrected whilst the facts are fresh in mind.

CHAPTER III.

THE GENERAL MANAGER.

Duties and Qualities of the Manager.—The general manager—or, as he is frequently termed in minutes and correspondence, *The manager*—is the officer on whom, above all others, the profits of the company depend. His duties cannot be defined, and are limited only by the articles of association. Within those articles (and it must be remembered that no one can travel outside them without incurring personal liability) he is an autocrat, controlling and directing everyone connected with the concern excepting the secretary and auditor, and himself subject only to his directors. Every servant of the company, from the works manager to the youngest rivet boy, or the office boy, is subject to his influence, and must be more or less inspired by it. *Esprit de corps*, so necessary for successful working, will only permeate the mass of employees when it first starts with him, and no supervision, no regulations, no system, can fully supply the place of it. Mr. Ruskin's ideas on economics are frequently open to grave question, but he occasionally, in his own unequalled manner, throws light on some obscure point of them, which may be profitably pondered by practical men. As for instance: "The universal law of the matter is that, assuming any given quantity of energy and sense in master and servant, the greatest material result obtainable by them will be, not through antagonism to each other, but through affection for each other." And again: "Supposing the captain of a frigate saw it right, or were by any chance obliged, to place his own son in the position of a common sailor, as he would then treat his son, he is bound always to treat everyone of the men under him. So, also, supposing the master of a manufactory saw it right, or were by any chance obliged, to place his own son in the position of an ordinary workman, as he would then treat his son, he is bound always to treat everyone of his men. This is the only effective, true, or practical rule which can be given on this point of political economy." And which universal

law and practical rule, strange as it may appear, can be equally found in the musty tomes of dryasdust economists, if we only take the trouble to search for and understand them. They are the foundations of equal justice, the only method by which men can be ruled short of force and compulsion, which nowadays are impossible.

Capacity for Justice.—The first and most important necessity for a manager is, therefore, the capacity to be just, which comprises the ability to see the workman's side of the case as well as the employers, and the courage to hold an even balance between the two. He will find plenty of scope for the exercise of this talent, both in adjusting differences between the foreman and workpeople, and also in training his subordinates to equal justice. British working men, with all their faults, appreciate this quality, and when men attribute it to their employers it is easy to settle many otherwise irritating complaints and disputes. The feeling permeates the mass, slowly it may be, but none the less surely.

Necessity of Discipline.—On the other hand, he must be a firm disciplinarian. He must rule with an iron hand, although he wears a silken glove over it. When once he has come to a decision he must not waver; having given careful attention to all the circumstances, he must adhere to the decision he gives, and not revise or vary it at every fresh importunity. Nothing so rapidly creates contempt in the minds of workpeople as a jelly-fish state of mind, impressionable by every fresh influence brought to bear on it. He must, when passing through the shops or standing on the galleries, watch the general conduct of the men, and draw immediate attention to, and sternly rebuke, any idling, inattention or unsteadiness at work, or larking. Bad timekeeping should be reprovod by the timekeeper and shop foreman, or leading men; but it is possible that they may be occasionally guilty of it themselves. The manager should, therefore, himself take an occasional survey of the time kept by the employees of all ranks and conditions.

Routine Duties.—The routine duties of the manager are many and varied. All business correspondence—that is all the correspondence of the firm not specially relating to the board, &c., which will be taken charge of by the secretary—will come under his notice. Part of it will be retained by him for the replies to be dictated to his own

shorthand writer; the remainder will be distributed to the various officers who have to deal with them. It is desirable that all letters sent away from the works should be signed by the manager, excepting those emanating from the secretary's department; but whether this is practical or not depends on the size of the works and the arrangement of the buildings. It is quite feasible where the works are small or the offices concentrated; it would be a reckless waste of time and energy to attempt to sign every memorandum and docket issuing from extensive works, with offices necessarily wide apart so as to be near the departments they serve. It is important to remember that the manager may do as much harm by ill-directed, fussy meddling as he can by procrastination or neglect of details. There is a happy mean to be hit, which is not always attained by the youthful and ambitious but injudicious neophyte.

Selection of Staff.—The selection of the staff rests with the manager, and unless he has, either naturally or by attainment, the faculty of selecting the best men for the various posts, he will involve himself in much after-trouble, and probably bring some of the departments into confusion. We are assuming the office staff to be under his control. In some firms it is usual to place the accountant and cashier, and all other officers so far as accounts are concerned, under the supervision of the secretary, and possibly this is the better plan. There need be no difficulty nor clashing in such an arrangement. On most railways there are station-masters who are also goods agents, and these report to the superintendent of the line on traffic matters, and to the goods manager on goods and mineral affairs, without any confusion or overlapping arising. It must, therefore, be understood that what is said respecting the manager in connection with the office staff will be equally applicable to the secretary when that gentleman takes charge of the accounts branch of the work. So far as the works proper and drawing office are concerned, the manager, however, will be the "fountain of honour," and will either make or recommend the promotions to be made. With these promotions or recommendations the directors should be careful not to interfere without very grave reason, and then in such manner as will not militate against the authority of the manager, an authority which depends almost as much on what is imputed by his subordinates, as on written agreement and the acknow-

ledged constitution of his office. We have all heard of an "uncrowned king" who ruled more autocratically than an emperor, his power being founded on the wisdom attributed to him by his subjects, and this "uncrowned kingship" may be found in all associations of men. Where a works manager is in being, the general manager should consult with him on all promotions and changes within the works: where there is only one manager he should take counsel with the foremen. Even if he overrides their advice, and follows his own opinion, he flatters by consulting them, and thus renders easier the position of his protégé. Most men are human, and vanity is a very human quality; the astute Machiavelli says, "it is to be observed, men are either to be flattered and indulged, or utterly destroyed," and the flattery which the Italian recommended his prince to employ cannot be unwise in lesser men. One axiom should always be remembered by the manager, and impressed by him on those whom he consults, namely, that the promotion shall be dictated by the man's fitness for the new appointment, and not conferred merely as a reward for past services. These are frequently the best credentials for good work in the future, but they must be deemed only credentials to be scrutinised and compared, and not absolute claims to advancement. Where, however, promotion can be given within the works it should be preferred to bringing in a new man from outside. Nothing tends so much to promote indifference and stagnation as the conviction that no work, no industry, no ability will procure advancement, and that the only way to obtain it is to leave the firm.

Selection of Office Staff.—The promotion of the office staff is frequently more difficult to deal with than even that of workmen and foremen. A man may be an excellent correspondence clerk, or a most exemplary cashier, and yet be unable properly to grasp the many complicated questions which come before the accountant for settlement. He naturally expects the promotion when a vacancy occurs; his necessities make him covetous of the increased emoluments; but the services he has rendered in the past, the satisfaction which he has given in his present post, must not be permitted to govern the appointment to the prejudice of the firm if he is not qualified, nor even if he is less qualified than another, for the new duties. The saying may seem a hard one, but is equal justice.

Qualifications as Engineer.—It is almost superfluous to say that the manager should be a highly-qualified engineer; not necessarily an eminent specialist, but a good all-round man, who has sufficient grasp of all the departments to appreciate at their proper worth the reports and suggestions made by those immediately in charge of them. He may not be so clever a mathematician as the draughtsman, nor so skilled in foundry practice as the foreman moulder, nor so practised a woodworker as the pattern-maker; but he must be more than any of these one things—by his general technical knowledge and common sense he must be able to reconcile their conflicting claims, and direct them all to the making of a profitable revenue account. Only by scientific ability can this be done in the present days of fierce competition, but it must be ability which duly estimates the correlation of all forces, not the monastic scholarship which severs its own individual researches from all others.

Working to Time.—Finally the manager must see that all work is done to time, both in the factory and in the office. As far as possible overtime should be avoided. Men cannot work extra hours for any continuous period without their energies flagging, and this produces either inferior work or decreased rate of speed. It is unnecessary to discuss the merits of any suggested or desired limitation of hours: whilst there is a minimum, below which it will not pay to run the machinery, there is also a maximum, beyond which any man's services become unremunerative. In an office no overtime should be permitted except in case of an emergency, or possibly at stock-taking. It will generally be found to arise either from bad office organisation or through deficiency of staff. In either case it conduces to carelessness in work, to procrastination, and to general irregularities, which frequently permeate other departments of the establishment. No capable manager will permit slovenly and dilatory office arrangements any more than he will tolerate a badly laid or late breakfast table. He will see that a sufficient staff is provided, and will then insist that they do their work.

Interviews.—One portion of the manager's business frequently causes him considerable trouble, and it is certainly difficult to properly deal with. We refer to interviews with people calling at the works, and desiring to see him on business. It is certainly annoying to a

busy man to lose time in listening to the maunderings of a sanguine inventor with an impossible ratchet brace, or the importunities of a commercial traveller, recommending some newly-imported brand of oil, or improved make of engine packing; such men are ubiquitous, and frequently elude the gatekeeper's vigilance. On the other hand, it is especially annoying to a possible customer, or an important visitor to be stopped at the gate, and cross-examined by the pensioned soldier or policemen stationed there, as to the business which makes him seek an interview. The manners of such men rarely err on the side of obsequiousness; their daily environment of workpeople forbids it; and an error of judgment, or passing fit of petulance on their part, may lose the firm an order or contract. It is better for the manager's shorthand writer, when he has one for his own special work, to see them, and either procure them an interview, or pass them on to the official of the yard, with whom, rather than with the general manager, their business lies. Where there is no shorthand writer (or private secretary) specially allocated to the manager, then one of the clerks of the general office should be detailed for this duty. It will be understood, of course, that this arrangement requires the offices to be at the entrance to the yard, as no visitor should be allowed to enter the works and wander about at his own sweet will. By some means or other, however, it is very desirable that the manager should obtain the reputation of being accessible, and, paradoxical though it may seem, he will best maintain the reputation by not deserving it.

CHAPTER IV.

THE DRAUGHTSMAN AND SUBORDINATE OFFICIALS. REQUISITIONS FOR MATERIALS.

Subordinate Officials.—The directors and secretary, the auditor, and the general manager form the brains of the firm ; they occupy towards it the same position which the general staff does to the German army ; on their deliberations and determinations the policy of the company is framed, and its success secured. There are, however, other subordinate officers, who render services of great utility, but who act under instructions rather than on their own initiative. It is, therefore, not necessary to discuss the qualifications they should respectively possess, as these will be judged by the secretary or manager who recommend them for promotion ; nor to detail their several duties, as these will be referred to as the work which passes through the factory is reviewed. A list of them will suffice. They are :—

In Secretary's Department.

The Accountant. | The Cashier.

In Manager's Department.

The Chief Draughtsman.
Draughtsmen and Tracers.
Correspondence Clerks.
General Office Clerks.
The Works Manager.
Shop Foremen.
Storekeeper.
Warehousemen.
Timekeeper.
Gatekeeper, and Night Watchman.

Drawing Office.—In one respect, this classification of the subordinate officers is perhaps imperfect. It is easy to trace the connection between a skilful and energetic manager and a profitable balance sheet ; it is difficult to see how much of this success is due to the assistance rendered by an able and painstaking chief draughtsman. Indeed, when orders fall off, and profits are consequently endangered, one of the earliest retrenchments made is a reduction in the drawing office staff, and this economy is

too frequently attempted by dismissing the most highly paid draughtsman or draughtsmen, and promoting juniors and pupil-apprentices so fill the places. Surely this is a strange method of securing prosperity. The very salvation of the firm depends on the facility it possesses for developing improvements on existing designs or modes of manufacture; other firms are striving to compass such improvements, and any which neglects the endeavour will assuredly fall behind in the race. The actual process of manufacture will usually be dealt with best in the workshops—by the works manager and his foremen—but the variations of, and improvements in, designs most frequently proceed from the drawing office.

Scientific Investigations in Drawing Office.—It is utterly wrong to think of this office as a mere workroom for tracers, and copyists of former designs; it is this false appreciation of the quiet and patient workers in scientific deduction which so frequently places our English manufacturers at a disadvantage as compared with German works. The phlegmatic Teuton has discovered the value of science, and consistently applies it to the problems of his work-a-day life. He knows that keen competition can only be met by avoiding waste in manufacture, by using up every bit of scrap which can be put to further service, by substituting the untiring machine for the exhausted workman. If he has not the knowledge himself he purchases it, and regards no portion of his wages sheet with greater complacency than that which is expended on research work. Crefeld, Darmstadt, Dresden, Ludwigshafer, and Nuremberg all bear testimony to the advantages which have been obtained through the development of higher technical education in Germany. Unfortunately, in England we have only half learned the lesson presented to us; our educational experts and captains of industry appear to think the chief need is schooling for the workmen, and that by teaching a fitter to produce imperfect drawings, or a working dyer to read a chemical equation without a blunder, great progress will have been accomplished. Much more than this is necessary to maintain our manufacturing and commercial supremacy, or what is left of it; but it is chiefly in the manufacturer's appreciation of the scientific branches of his establishment, and of research work that the need lies. We require more employers with Captain Cuttle's admiration of the man chock full of science.

Instead, therefore, of placing the chief draughtsman among the subordinate officials, we might more properly consider him the *aide-de-camp* and most trusted ally of the manager.

Purchases and Sales.—Whilst the several officers we have named have distinct and varied duties to perform, duties which must not conflict or overlap, they are all engaged in two great divisions of trade: first, in purchasing materials and stores to undergo further manipulation; and secondly, in transforming them into finished machines, and selling the completed product. In the purchasing department, we must consider not only the materials purchased, but also the ordering, receiving, and examining them; all tests of raw materials and research work, instituted for the purpose of effecting improvements in, or substitutes for them; and also such work in the drawing office as may be a needful preliminary to the ordering of plate, forgings, or other articles for some particular contract or specification. In the sales department we must consider the finished article sold, and also all work in the drawing office which is not an absolute essential for the purchase of stores; all research work instituted for the purpose of improving the design of any machine, or other product; all advertising and other solicitation for the extension of the business; and all the varied services connected with the packing, forwarding, and recording of the articles sold. The distinction is not a mere academic or fantastic one: it has a practical application, and though the lines of demarcation may appear blurred, the manager must not forget that they exist. Losses may arise from two causes: either from injudicious method of purchasing, or from insufficient prices obtained for the finished goods, the latter cause being affected by and including excessive expenditure in workmanship, or establishment charges. It is, therefore, important that the directors and manager should not only locate their losses or diminished profits to a department of the works, such as the smithy, joinery, or machine shop, but should also determine whether they arise through improper or injudicious purchases, or accrue entirely after the materials are in the possession of the firm.

Inception of Orders for Purchases.—It is necessary that the actual orders to vendors should be issued only from one source, and that is, the general office, where the invoices for the goods are afterwards checked and passed

for payment. No effective control could be maintained over the purchases of the firm if every shop foreman were permitted to pledge its credit for anything he might at the moment require. On the other hand, the clerks in the general office can only act upon requisitions furnished to them, and these must come either from the drawing office or the storekeeper.

Drawing Office Requisitions.—Drawing office requisitions will only be issued for stores or materials required of special quality, construction, or dimensions, and which are not in the possession of the storekeeper, nor usually kept by him. In some branches of general engineering business they will seldom be required; in others, as where special forgings are required, made to drawings or templets, or where plates or angles of special and varying sizes are wanted, they will be more numerous. Such orders demand special care in their preparation, and careful examination and comparison of the dimensions with drawings or models; it is therefore better that they should be written out in the drawing office, either by, or under direction of, the draughtsman in charge of the job, and sent to the manager for signature. If multiple copying is used a press copy can be taken in a book retained in the drawing office, and a second copy in a book kept in the general office. After the second, or general office, copy is taken the order will be sent out—that is, issued—from that office in the ordinary course. The following form of order sheet was found suitable for some portion of the orders for a shipyard, and with trifling modifications may be adopted for a general engineering factory:—

Order No..... Date.....189.....

To.....

Please supply the following.....to be delivered at our works, carriage paid, on or before the , 189.....

For the CLYDESDALE ENGINEERING COMPANY LIMITED.

....., GENERAL MANAGER.

No. Required.	Length.	Breadth.	Thick- ness.	Quality.	Marks.

Storekeeper's Requisitions.—The storekeeper's requisitions will, however, be a much more constant quantity, and will comprise a vastly greater number of articles. He will require to keep his various stocks supplied, so that there may be no delay in the progress of work through some of them being run out. The storekeeper should be a man of considerable intelligence, with sufficient experience to enable him to forecast the probable demands which will be made upon him, and with capacity for estimating rapidly the quantities or weights of articles in his possession. His stores ledger will give him the approximate balance on hand, but with the numerous duties he has to compass he cannot constantly turn over its pages and add up the receipts and issues: his eye must be the guide to the waning bin, and the ledger merely confirmatory of what he has previously seen and appreciated. As, however, the demands he makes will be for stock articles, and do not require such conformity to special directions as do the drawing office requisitions, it is not necessary, nor even desirable, for him to fill up the order himself. A stores requisition book should be compiled from time to time by him, and sent to the general office for the several orders to be made out under the authority of the manager.

This stores requisition book should be ruled with six columns, for the following particulars to be inserted:—

1. Date of requisition.
2. Description and quality of goods required.
3. Quantity required.
4. By what date required.
5. Quantity now in store.
6. From whom ordered.

The particulars for the fifth column can easily be obtained from the stores ledger, whilst the last will be filled up by the order clerk before the book is returned to the storekeeper.

Passing of Stores Requisitions.—No doubt the responsibility for ordering material rests primarily with the manager, but undoubtedly the directors should also exercise some sufficient control over the issuing of orders; if they neglect this they will subject themselves to serious animadversion in the event of any loss or financial difficulty arising in consequence of reckless, or even injudicious, ordering of materials. Both the draughtsman and storekeeper should therefore be required to so

arrange the times of their requisitions that they may be submitted to the board before the orders are issued; and any special requisitions which may be necessary in the intervals should be specially noted, and the confirmatory sanction of the directors obtained to them. It will certainly be a little saving of clerical labour to place on the board table the copy letter book of the draughtsman, and the requisition book of the storekeeper, but it is probably better to compile a list in the following form, so so that the directors more readily see what goods they are ordering, and also their estimated value.

THE CLYDESDALE ENGINEERING CO. LTD.

The sanction of the Directors is requested to the ordering of the following supplies:—

Date.	Description.	Quantity wanted.	Estimated price.	Estimated Cost.	Proposed to be ordered from
The following have already been ordered by authority of the manager.					

.....GENERAL MANAGER.

This sheet should be initialed by the chairman or one of the directors, and a minute passed and recorded in the following or similar form :—

“The manager submitted list of supplies required, and of those ordered by his authority since the date of last board meeting, the estimated cost of which amounted to £, and the ordering of same is hereby sanctioned and confirmed.”

CHAPTER V.

PURCHASES AND INSPECTION OF MATERIALS.

Form of Orders.—Different firms use various forms for their orders. Some employ either counterfoil books or carbon copy-books, whilst others prefer loose order sheets of which copies are taken in a press copy-book. It is purely a matter of convenience, which should be regulated by the conditions and requirements of each firm. Where, however, either counterfoil or carbon books are employed, the books as well as the orders should be numbered—thus, 37/96,—signifying order No. 96 in book 37. This will permit of two or three books being employed at the same time (a matter of some convenience during a pressure of business) without much difficulty arising in checking the invoices or tracing the orders. In the same manner the press copy-books should be numbered, so that the particular book may be readily found afterwards, although only one of them should be in use at the same time. The books should in all cases be thoroughly and carefully indexed.

Whichever method is adopted, the order should always contain the following particulars, viz. :—

- The number and date ;
- Name of the firm to whom given ;
- The conveyance by which the goods are to be forwarded ;
- The particulars of the materials ordered ;
- The tests, if any, required ;
- The date delivery is wanted ;
- The marks to be placed on the goods ;

and sometimes

- The purchase price ;

but this, however, is not always necessary or desirable. It should either be signed by the general manager, or, in his absence, by some person authorised to sign on his behalf.

Copyable Printing Ink.—If loose sheets are used they should be printed in copyable printing ink ; indeed all forms of which it is intended to take press copies should be printed in this manner. Many of the railway and other

carrying companies now have their invoices and bills of lading so printed, and find it of considerable convenience. In case of disputes it is well to have complete copies of all documents, and not merely of the written matter, leaving that which is printed to be surmised from the context.

Placing of Order.—Before the order can be placed with any vendor, there are some steps to be taken which are of more importance than the clerical detail of filling up the form. It will be observed that the name of the firm to whom it has been given has to be filled in the storekeeper's requisition book by the order clerk in the general office. By what principles or instructions must he be guided in selecting this name?

Orders Specially Placed with a Favoured Firm.—It occasionally happens that an order has to be placed in the hands of some particular firm irrespective of any comparison between the prices they ask, and those demanded in the general market. Sometimes this is part of the contract for the sale of the finished article, and arises from the requirement of the ultimate purchaser. The Admiralty, for instance, require that shipbuilders who are not on the list of engine builders shall submit for approval the name of the firm whom they propose should engine a warship; and, in like manner, the specifications of some merchant vessels require that certain portions of their equipment should be obtained by the builders from particular firms. Such special stipulations, however, are not very frequent; they are, or should have been, provided for in the estimate, and the manager will himself indicate the firm to whom the order should in such cases be addressed. Exceptional matters of this sort must not be left to the determination of the order clerk.

The Cheapest Market.—More usually, however, the destination of any order will be ruled by the price asked for the article by competing firms; it will go to the cheapest vendor. Sometimes this price is ascertained by comparison of different catalogues; at others by direct inquiries previously addressed to two, or three, or more makers. In some instances the quoted market price will be the figure asked by any maker in the trade, and it is only needful to refer to a daily paper for this figure; the *cheapness* will be determined by the relative qualities of the article which the competitors turn out. In all cases, however, considerations of technic and polity arise, which

are utterly beyond the comprehension of any ordinary clerk, and the name of the vendor must be inserted in the order, and afterwards in the requisition book, under the direct instructions of the general manager or one of his authorised and qualified engineer assistants.

Record of Catalogues and Tenders.—The very slightest consideration should show that it is desirable to keep such a register of catalogues and tenders as will facilitate reference to them: a few days' experience in an estimating office will satisfy even the tyro that this is imperative if he is to comfortably and quickly get through his work. For this purpose an index book may be used, but it should be on the dictionary plan, and register both the name and description of the article quoted for, and the name of the maker quoting. Thus quotations are received from Messrs. Howard and Smith for two machines, and they will be indexed in three places as under:—

- (1) Howard and Smith—Screw-cutting
Lathe, Milling Machine 1st April, 1897.
- (2) Lathe, Screw-cutting—Howard and
Smith 1st April, 1897.
- (3) Milling Machine—Howard and
Smith 1st April, 1897.

This index, however, furnishes nothing but the name of the machine, of the maker, and the date of quotation or catalogue. It is true this may be extended into a short description of the machine, with its price, but this will involve so much unnecessary labour that the index itself will speedily be permitted to fall into arrear. Next to the index, which furnishes the clue, it is desirable that the original quotation or catalogue should be readily available. For this purpose, letter quotations may be filed in alphabetical order, on Shannon, Amberg, or other like files, whilst catalogues may be placed in suitable pigeon holes, or box files, under the first letter of the name of the firm supplying them. Thus, when a price is wanted for a milling machine, a reference to the index will show that they have not only been quoted for by Howard and Smith, but also by Brown and Jones, Robinson and Sons, and Evans and Griffiths; whilst if it is required to ascertain whether McIntyre and Dunlop supply anything beyond steel rails, a reference to the index letter M will show that they have also quoted for steel blooms, billets, and slabs, spring steel, and planished steel bars for shafting.

The Card System.—The objection to a book index is the difficulty of dividing it so that sufficient room shall be available for all the letters, and that one letter shall not be exhausted whilst the others are still almost intact; and this difficulty is greatly increased when the dictionary method is adopted. The card system of the Library Bureau Limited, or the Ceres Company (Mr. T. Bowater Vernon), obviates this, and will be found more rapid in manipulation and reference than any book. The Ceres system of filing letters and pamphlets also affords one of the most convenient forms of putting away quotations and catalogues to be available for future use. The advantage of the card system and Ceres file is that obsolete quotations can easily be removed from both index and file without interfering with the other papers, thus reducing the number which have to be searched through on any future occasion.

Illicit Commissions.—In determining the firm with whom any order shall be placed there is one grave consideration which really affects the question of the "cheapest market." It is the giving to the employes of the purchasing firm secret commissions on the amount of the purchases. Fortunately this pernicious practice is not so common in England as in some countries abroad, but even here there are far too many instances of it in connection with a few trades, and it is not unknown in certain branches of engineering. The effects are so disastrous on any firm subject to its influence, whether as giver or receiver, that both directors and managers should use every effort to stamp it out. Whether it be merely a fat goose at Christmas or $2\frac{1}{2}$ per cent commission on the turnover to a storekeeper or sub-manager, the immediate effect is usually to pass inferior goods at an enhanced price, and the later result to depreciate the quality of work turned out by the purchasing firm. If for no other reason than this, that these secret and illicit commissions are occasionally passed (though we believe not to any large extent in Great Britain, and seldom, if ever, with reputable firms), it is desirable that the directors and general manager should exercise very close supervision over the orders sent out, and determine to whom they shall be allotted.

Date of Delivery.—The date of delivery inserted on the order is an important portion of it, and any delay

beyond the allotted time may in some cases have serious results. If the goods are required for any particular contract their late delivery may cause the contract to be behind time in completion, and thus involve the firm in difficulties with the ultimate purchaser. Some method must therefore be adopted for ensuring this date being complied with, or at least of the attention of the vendors being drawn to the fact that the goods are overdue. In some establishments a register is kept of all orders sent out, and these are marked off with the date of completion. This system is effective, but very troublesome, and in small establishments either increases the cost of management unnecessarily, or causes other duties to be neglected. It will in general be found sufficient to mark off on the counterfoil, or the press-copy order book, the goods received, and at stated intervals, say once a month, to go through the book and extract particulars of uncompleted orders. The several suppliers should then be written to by the order clerk, and the list kept before him until cleared, for the purpose of repeating the applications at frequent intervals. Printed forms may be used for this purpose, but they are open to the objection that, like the acknowledgment notes of railway companies, they are soon regarded as meaningless routine, and so are disregarded. Although it is rather more trouble, it is better to use a written or typed letter, the wording of which may be varied with the circumstances and urgency of the case.

Penalty Clause.—It is, perhaps, well to remember that in few cases will a penalty clause inserted on the face of an order be of any avail in case of delay in delivery of the goods. Even the use of the expression “as and for liquidated damages” does not appear to overcome the difficulty. Mr. Josiah W. Smith, Q.C., formerly a County Court Judge, says: “The construction of the agreement will not depend on the name given in it to the sum; for it may be construed to be a penalty, though expressed to be a sum payable by way of liquidated, that is, ascertained damages, and not by way of penalty; or it may be construed to be liquidated damages, though expressed to be a penalty.” Cases may, and do sometimes, arise where it is absolutely necessary that the vendor should be fixed, under liability to damages, to a certain date for delivery of goods or materials, but such cases should be dealt with under specific agreement, and not by a mere remark on

the face of the order; and the agreement should always be prepared by, or under the advice of, the solicitor to the company.

Inspection of Materials in Progress.—The giving an order is the first active step in procuring materials or goods; the inspection of them prior to acceptance is the second. In some cases it is desirable, and at times absolutely necessary, to inspect finished, or partly finished, materials during the progress of their manufacture, and not to rely on the detection of faults by an examination after delivery at the works. An instance of this is where large forgings of complex or irregular shapes have to be procured from another manufacturer, and where great inducement exists to “jump on” some of the parts, instead of forging the whole piece out of the solid. The most effectual safeguard against such practices is to keep an inspector at the producing works to watch the forging during its progress. Some firms are truly said to be above suspicion, and these are largely patronised by the Admiralty; yet even at such works the omnivagant inspector from Whitehall may be found just as frequently as at smaller or less reliable factories. The practice is a good one, and one of the few Government regulations which may, with advantage, be copied by the private engineer.

When the purchasing firm are shippers, either as merchants or as engineering contractors supplying their own requirements for concessions abroad, the necessity for inspection during the progress of the work becomes more imperative. Faulty workmanship, or irregularities in construction, cause far more trouble when discovered at the destination in China, Egypt, or South Africa, than when discerned and remedied at home. If the goods are for a customer, such defects lead to claims, irritating correspondence, and sometimes to loss of connection; if they are for some foreign contract, undertaken by the firm itself, the results may prove equally disastrous, since the completion of a large extent of important work may be delayed, and heavy penalties or other losses incurred.

There is a difference, however, between the two inspections, which to some extent modifies the qualifications needful for the men selected as inspectors. In the case of forgings, or other articles purchased for use in England, the conditions of manufacture are usually comparatively simple, it being necessary only to see that the proper quality of raw material is used, and that the patterns and

specifications furnished by the purchasing firm are strictly adhered to. For this purpose, a man may be selected from the particular trade concerned of sufficient ability to justify his promotion to foreman's rank, if there were a vacancy: an assistant foreman, or senior and reliable leading man should be admirably fitted for such a post if the staff of the establishment were efficient and trustworthy. It must, however, be remembered that tact, and certainly some degree of courtesy, are essential if the inspector is to perform his duties without causing unnecessary friction between the two firms. He should have impressed upon him, before commencing his journey of inspection, that he is merely an inspector, charged with the duty of seeing that certain conditions, already agreed to, are strictly complied with, and that he has no authority to interfere with the management of the works to which he is proceeding, nor to make impertinent suggestions for improvements in methods of working. Engineers of all grades are usually glad to discuss various systems of construction, and even of shop management, but, whilst open to discussion, they naturally resent outside criticism of their own particular adoption. The inspector of foreign work, however, requires something more than skill in the technic of his own branch of the trade, and tact in the execution of his office. He will be, or should be, furnished with a complete specification, every detail of which he has to see complied with; he will receive packing and forwarding instructions, which he has to see carried out in all cases (and they are the majority) where the goods are forwarded direct from the manufactory to the port of shipment, and not passed through the purchasing works for examination, or further operations thereon. Now, for this duty it is evident that a better and more widely trained man is desirable than would be needful for inspection of a forging for home use. The latter should be a skilful, if not indeed a perfect, fergeman. The former should be a thorough mechanical engineer, with a complete knowledge of the methods of packing and forwarding for the different markets. Whilst he will, in these respects, be guided by the instructions he receives from the manager, just the same as the storekeeper at home is, he will yet be compelled to rely and act upon his own judgment, and answer, without reference to his superiors, many questions in reference to the interpretation of these requirements.

CHAPTER VI.

RECEIPT OF MATERIALS AND PASSING OF
INVOICES, &c.

Receipt of Materials at Works.—The greater portion of the materials and stores required by the engineer will, however, be delivered at his works. This is the case even with stores required by railway and mining engineers, building contractors, and ship and marine engine builders, who frequently have temporary premises far away from their main works. For the moment we must consider these temporary establishments as following the same routine in the receipt of materials as obtains at headquarters.

The first person who admits the goods into the yard is the gatekeeper. Whilst in relation to the removal of material of any description from the premises he has to be almost a military martinet, his duties in relation to receiving thereof are much less onerous. Briefly, he must see that no absolutely improper carts are admitted, an impeditive which he will seldom need to exercise, and that all admitted proceed directly to their respective stores or other places of delivery. When, however, the cart weighing machine is at the entrance gate, he must also see that all goods in bulk, such as coal, coke, hay, straw, lime, and iron, when forming a complete load, are properly passed over it. To facilitate reference to the weights thus obtained, a record book should be kept, which may be in either of two forms. For the first a foolscap book, of cheap paper, which, however, must admit of writing with ink, may be used, and if it be ruled in the following form it will be found convenient and inexpensive :

[illegible]

This form necessitates a journey by the accountant, storekeeper, or other official, every time he wishes to make any reference to the firm's weigh-book. Another method may therefore be adopted, and that is, to keep a counter-foil book for inward weighings, the same as for outward weighings, and to tear off the slips for each delivery and send them to the storekeeper, who will thus have the necessary record always at hand in his own office. The form should be the same as the ordinary outwards book (which may be procured at any commercial stationers), the words "received from" being substituted for "delivered to." It is convenient that weigh-books should be a different colour for received and delivered goods, and as the received weights are in the nature of a credit to the vendor it is better to use the same colour as for credit notes, which is usually red, leaving the delivery weighing-books of their natural colour of white.

Receipt by Storekeeper.—The person who really accepts the goods on behalf of the firm is the storekeeper, and by him the preliminary examination has to be made. It is important that this should take place, if the goods are delivered by rail, canal, or other common carrier, before he signs for them, so that he may notify in the book any visible marks of damage, otherwise any subsequent claim may be repudiated on the ground of "good" signature. When the goods are packed in matting or other covering which cannot conveniently be removed at the time, it is advisable to protect the firm by a remark, "condition not known."

A more particular examination must be made, and the result of it placed on record when the materials are passed into store. It is almost unnecessary to say that this should be the same day they arrive in the yard, unless some great temporary pressure of business interferes. A goods received book must be kept by the storekeeper, in which the goods are entered immediately they are accepted. A book, ruled in the following form, will answer the purpose in the majority of engineering works. It need not be expensive in paper or binding, as it has not such continued references made to it as to a ledger; but, on the other hand, it should not be too thick, as, lying continually on the counter or desk, it is apt to get very dirty if kept long in use.

Date.	From whom received.	Order No.	Description of Stores.	Number received.	Weight received.		INVOICED.									
					Cwt. Qr. Lb.		Number.	Weight.			Price.	Amount.				
					Cwt.	Qr.		Lb.	Cwt.	Qr.		Lb.	£	s.	d.	
1898. Jan. 9	Evan and Daniel.	37/96	3 in. Rivets.	—	0	—	—									
"	Roger Bacon.	36/437	Crown Deals.	1 Stand.	—	—	—									
"	James Smith.	37/97	1 in. Hose Piping.	90 yds.	—	—	—									

The entries are made without any classification, either of character of goods, or of orders for which they are intended. Those articles which are purchased by weight must be passed over the weighing machine (there must always be one or more in the stores), those purchased by number or measurement must be counted or measured; and the weights, numbers, or measurements so arrived at must be those entered in the receipt book in the columns "number received" or "weight received." Goods weighed in bulk at the entrance gate will be entered, after inspection and receipt by the storekeeper, in accordance with the gate weight ticket, or weight book. Deals, and timber of that class, will usually be accepted on the vendor's measurement, but care should be taken to check it occasionally when stacked, more particularly if it has been conveyed by rail or canal.

The Storekeeper.—It is absolutely necessary this work should be discharged with great care and conscientiousness, because any perfunctory performance of it may lead to great trouble and loss. On the one hand, if the goods are underweighed or undercounted, a long correspondence and irritating dispute may arise with the vendors, and a claim made upon them may eventually have to be withdrawn, with great discredit to the purchasing firm; on the other hand, if short weights or short measurements are not detected, the profits may be reduced through materials being paid for, and never received. And the work has to be done in the midst of other conflicting duties equally important, and whilst all the clatter of store issuing is going on around. It will, therefore, readily be seen that the choice of a storekeeper is a matter of considerable moment for the smooth working of an engineering firm. Some managers favour

the appointment of retired or pensioned non-commissioned officers of the navy and army for the post, on account of their accustomed submission to routine and discipline, and happy method of enforcing on others the orders entrusted to them. More, however, is needful for a good storekeeper than rigid adherence to instructions, and blind submission to orders. Some knowledge of the trade should most certainly be possessed by him, although it is not necessary that he should be a trained journeyman fitter, or millwright, or electrician. It is perhaps easier to impart to the retired soldier or sailor some knowledge of trade, than it is to implant in the ordinary British labourer or mechanic habits of discipline and obedience. The preference for non-commissioned officers is therefore well founded on the excellent characters they have already obtained, and the qualities of adaptability they have displayed, but the selection must be a judicious one. All men are not equally worthy who have worn stripes on their arm.

Delivery Notes.—Most firms forward delivery notes at the same time as the goods, and these, when received, should immediately be handed over from the general office to the storekeeper to be checked. It will be observed that the goods received book has on the right-hand four columns for number and weight, price and value of goods invoiced. None of these must be filled in from the delivery note; they must all be entered from the monied invoice, which will in due course be received through the accountant's department. But any discrepancy between the goods received and those entered on the delivery note must be marked on the latter in red ink, whether the difference be in quality or quantity. The notes must be retained by the storekeeper until the monied invoices are received, and returned to the accountant attached to the invoices when the latter are checked and certified.

Tests of Materials.—There are certain materials which cannot finally be accepted by the storekeeper until they have been tested for strength, and sometimes for chemical purity, by the technical officers of the company. The more delicate tests should be made in a properly fitted engineering laboratory set apart for that purpose, and by men thoroughly qualified by scientific training to take and tabulate exact observations, and appreciate the value of any variations therein. It is difficult to set any limit to the benefits which Messrs. Denny have derived from their

experimental tank at Dumbarton, or the advantages which shipbuilders in general have gained from the investigations there conducted. Such laboratories are, however, expensive and difficult to construct, and can only be indulged in in a complete form by wealthy firms. But even on a very small scale they are most serviceable, and exert an invaluable influence in inducing precision of work throughout the establishment. In general engineering establishments, however, the majority of tests of materials will be conducted in the workshops, and by the ordinary working staff. It is necessary that in these workshop tests the same delicacy of treatment, and accuracy of observation, should be used as would be adopted by the technical or scientific officers in their own operations; and the best way to secure this is to regard all tests, whether for the general manager, the drawing office, the stores, or workshop use, as strictly scientific operations demanding the utmost possible care in manipulation. Such care, if the works manager insists upon it in all cases, soon becomes a matter of habit, but much depends on the way in which it is regarded by him. We remember a case where a large number (30,000) of yellow metal ship bolts from one of the first copper works in South Wales were almost condemned, because nothing would induce the works manager to make the agreed tests of them with sufficient delicacy and care; near, or near enough, was his constant motto. A threat of official condemnation at length induced him to have the work performed in proper manner, and they were then found to be, as from the first they had been, fully up to Admiralty requirements. These requirements were undoubtedly, and properly, very stringent, but the case illustrates the advantage of making nicety of manipulation a matter of habit. Had it been so in this instance the temporary irritation which arose, and threat of official censure, would have been avoided.

The earliest possible opportunity should be taken of making these tests. Many stores and materials are purchased on short terms of payment, and it is desirable that any claims for rebates and allowances, or notices of rejection, should be rendered before the monthly statements are sent in.

Invoices.—In some instances invoices will be sent with the goods; in others they will be rendered at the end of the month. Let us follow these invoices. In some firms it is usual to register them as they come in, and affix a

consecutive number to each; but, as this is merely a pedantic addition to clerical work, it cannot be recommended. It is, however, desirable to enter such invoice and statement, and indeed all documents received, in the letter register hereafter described. The invoice passes first to the accountant's department, and is there marked at the foot with a rubber stamp in the following manner. The stamp should be as small as is conveniently possible.

Goods received by.....	
Goods passed by.....	
Marked off Order-book by.....	
Prices checked by	
Calculations checked by	
Passed for payment by	
.....Manager. ....Director.	

The stamp indicates the course which should be pursued. The invoice is sent to the storekeeper, who examines it with his goods received book, and if it agrees therewith, affixes his initials. It will be remembered that in the received book there are two columns (on the right-hand side of the page) for quantities, prices, and values of goods invoiced. These can now be completed from the invoice, and must exactly agree therewith. Of course, in a quantity of general stores, or of iron and timber delivered to the firm at various times, but charged in the one account at the end of the month, the invoice amounts will be scattered in various places through the book, but the totals of the two will agree. The next blank in the stamp will be filled by the storekeeper's initials when the invoice is for such general stores as he himself enters in his requisition book, and examines and passes on delivery. When, however, it is either wholly for, or includes any special stores which have been ordered through the drawing office, or other technical department, or any machine, or part of machine, the invoice must be passed from the storekeeper to the technical (*i.e.*, engineering officer) who has examined the stores or machine, so that he may certify that the goods have been passed by him, as agreeing with the order given,

and being up to the specified standard of quality in both material and workmanship.

Examination in Office.—The invoice will then be returned to the accountant's office for the checking of it to be completed there. First, the various orders affected must be marked off on the counterfoils, or in the press copy book, as executed or partly executed. In the latter case the quantity received must be inserted. In order that the clerk may have a more speedy check on the supply of goods ordered than would be afforded him by the monthly invoice, it is a good plan to have the delivery notes received with them sent to him daily after being checked by the storekeeper, to whom they must, of course, be returned. He will then mark them off on the counterfoil, or copy of the order by a tick, crossing this tick when the invoice has been passed by him. This plan causes very little clerical work, and prevents duplicate invoices being passed for any order.

The next care is to check the prices at which the goods are charged. We have seen that it is important to place the order in the cheapest market, and that to secure this end catalogues and tenders must be obtained, and carefully filed and recorded. It is evidently equally important to see that these quoted prices, on which possibly calculations and estimates have been based, are adhered to by the vendors. Naturally these prices must be checked, and, if necessary, corrected, before the calculations are examined, but when this has been done the extensions of the amounts charged must be carefully gone over before the invoice is ready to be passed for payment. Any corrections necessary should be made in red ink.

Now, there is one point which must not be overlooked in connection with the checking of invoices. The storekeeper enters his received book from the invoice as it comes from the vendor, but it is necessary that this book should agree with the amount debited to stores account in the general ledger. If, therefore, any alteration is made in an invoice the nature and extent of the alteration must be notified to the storekeeper, who will correct his book accordingly. These notifications must always be in writing.

Passing for Payment.—A space will be noticed on the stamp "passed for payment by." This is for the use of the head of the accounts branch of the office, either the

accountant or the secretary. Where the two offices are distinct, it is certainly desirable that the invoice should be generally overlooked by the accountant, and this memorandum signed by him. The object of these signatures is to fix responsibility. The secretary has other and more important duties to discharge than examining invoices, and he should not be asked to certify to a service which has been performed by another officer. The accountant, on the other hand, has to make himself acquainted with every detail of the accounts, and to watch that every person about the premises who has anything to do with them treats them in a proper manner. His signature on the invoice is a certificate that he has satisfied himself that it has been properly dealt with, and that, as corrected if necessary, it is ready for payment when due.

Places for two other signatures are appended, for the manager and a director. Whether the manager should or should not sign all invoices is a matter of much dispute and variation in practice, and depends greatly on the size and nature of the works. The signing of all invoices certainly gives him a control over the purchasing department which it would be difficult to otherwise obtain, and if they are placed before him at regular intervals the tax on his time is not very great. It must be clearly understood that it is not intended thereby to express any detailed scrutiny by the manager. The director's signature should be affixed later, and merely signifies that the proper officers have examined the invoice, and found it correct.

The examination by the manager and director would thus appear to be of a very perfunctory kind, and on this ground it is sometimes objected to. But any gross error in purchasing, any manifest error or overcharge in price, will probably be noticed by one or other of them; whilst the mere knowledge that they will both inspect the invoices before they are paid will tend to promote care on the part of their subordinates.

Correction of Invoices.—We have referred already to the correction of invoices, and recommended that alterations therein should be made in red ink. If only ordinary double-entry accounts were kept it would be sufficient to post the invoices for the amount for which they are rendered, and to either forward debit notes to the vendors or obtain from them credit notes for any differences which may be discovered. But in engineering works the com-

plication of cost accounts must always be remembered, and provision must be made from the very first stage of the transactions for facilitating their working and securing their correctness. Moreover, the capabilities of the storekeeper must be remembered; there are works of such magnitude as enable him to be furnished with an efficient staff of clerks, and where his position is rather that of a departmental manager than of an ordinary storekeeper, but these are the exceptions rather than the rule. The usual storekeeper has neither the capacity nor the leisure for the niceties of correcting entries, nor should he have, under ordinary conditions, such additional labour thrust upon him. Taking into consideration all these factors, the better plan is to make the correction on the face of the invoice and advise the storekeeper thereof, so that he may make his goods received book agree therewith.

Returns and Rejections.—Precisely the same remarks apply to goods rejected or returned. They have not been taken over by the purchasing firm, they will not be paid for, they ought not to appear in the stores ledger either as received or issued, never having been, in a true sense, stores at all; and the most satisfactory course is to strike them out of the invoice. An additional, though possibly minor, reason may be found in the fact that if they are first posted to the credit of the vendor, and afterwards to his debit on their return, they improperly increase the totals of both purchaser and sales.

Debit and Credit Notes.—But it is equally necessary that the vendor should not remain under any delusion as to the amount at which his invoice has been passed; he should at the very earliest moment be advised of the correction which has been made. For this purpose it is desirable to use a specific form of debit note, an example of which we give below.

THE CLYDESDALE ENGINEERING COMPANY LTD.

DEBIT NOTE.

To

..... 189...

Please note that we have made the following corrections in your invoice dated 189...

Particulars of Correction.	Amount Deducted.		

We have passed your invoice for £..... and shall be glad if you will correct your books accordingly.

Yours truly,

For THE CLYDESDALE ENGINEERING COMPANY LTD.,
..... General Manager.

Possibly the vendors may in reply forward a credit note, that procedure being necessary for the completion of their own method of bookkeeping, and in such case the note may be filed along with the corrected invoice: it is useful to retain as evidence that the allowance or correction has been agreed to.

Packages and Discounts.—We fear we shall, by most accountants and bookkeepers, be considered heterodox in the suggestion we make for the treatment of packages, but as it has been practically tried in several firms with which we are acquainted and found successful, we can recommend it to our readers. It is simply to strike the charge for packages out of the invoice, and post to the credit of the vendor the amount as corrected. Of course this only applies to such of them as it is intended to return; if it is deemed advisable to retain them for future use, or if they have to be sent abroad, then they must be continued in the invoice, paid for in due course, and charged to a package account.

The simplicity of the method is the chief recommendation of it. The chief object which any respectable firm has in charging packages is to ensure their return, and it is quite right that in sending them away they should protect themselves against loss. But it is perfectly absurd to increase clerical work in the purchasing office by passing packages through the invoice book, posting them in the ledger, entering them when returned in the day book, and again making another ledger entry to clear the first debit.

It is impossible to urge too strongly that bookkeeping never makes profit. Its utmost merit is to prevent losses; and, therefore, any unnecessary addition to it for the mere purpose of producing uniformity or completeness of system is a tax upon the earning departments, and a tax which a judicious manager or board will sedulously discourage. It is sufficient to return the cases and wrappers as soon as they are empty, accompanying them with an advice note, but neither return nor advice should be neglected or delayed, or troublesome correspondence may arise, and the advantage of the reduced clerical labour be lost.

Discounts are of two kinds—trade discount, which is usually a percentage reduction of standard lists, and the ordinary cash discount. The former should always be deducted from the invoice, and given effect to in the storekeeper's goods received book. Thus, if the standard price per unit is 60s., with 40 per cent discount, the discount must be deducted from the invoice, if not already done by the vendors, and the goods received and entered by the storekeeper at 36s. per unit. The cash discount is more troublesome to deal with, as to reduce all the prices by $2\frac{1}{2}$ or 5 per cent would involve an immense number of calculations, and produce figures of fractions or decimals which would be most difficult to deal with in re-issuing the stores. It is quite true that it is done in some chemical works, but there the whole consignment of any material is charged to one process, and not issued by pounds and half pounds, or dozens and half dozens, as is the case in an engineering establishment. The preferable plan is to treat cash discount as an establishment item, and so divide it in the cost accounts, over the various departments affected.

Invoice Book.—The invoices, after final examination, must be at once placed in the invoice guard book, or secured in such position as will both keep them safely and render them available for ready reference. It is sometimes desirable to substitute a register for the guard book, entering and dissecting the invoices therein in the same manner, but keeping the invoices on files or in mechanical binders. This is particularly the case in some foreign countries, where the legal requirements as to invoices are stringent, and where insufficiency of stamps entails penalties on both the issuer and receiver. But there is undoubtedly a great objection to a separate register; it

involves additional trouble in referring to the invoices and creates risk of their being mislaid or lost. In this country, at all events, the guard book is the most convenient and economical method of keeping them. Of course, the invoices must be neatly folded and endorsed outside with the name and date. Sometimes a clerk will endeavour to "improve" on the endorsement, and save himself trouble, by folding the paper so as to display the invoicing firm's name, but this should never be permitted. Invoice headings are now printed in such variety of styles, and with such variation of space in printing, as to dissipate all uniformity where they are displayed. Another error to be guarded against is folding the invoice into too small a size, and in consequence crowding the book. This may seem a small matter, but such attempted economy generally results in inconvenience, and sometimes in troublesome blunders in posting or analysis.

The book should be ruled with vertical columns in the following manner, and paged only on the right-hand page of each folio. The left side of the book will generally contain the invoice and the process column; the right side will be apportioned to the analysis.

DECEMBER, 1898.

Total Amount of Invoice.	Invoice, endorsed with Date and Name of Vendor.	Process.	Iron and Steel.	Forgings.	Smiths' Iron.	New Machinery.	New Tools.	Sundry Stores.	Freight and Cartage.	Rents, Rates, and Insurances.	Royalties and Legal Expenses.

Now, it is evident that we have here a very complete and useful form of journal, so far as purchases are concerned—much more useful, indeed, than the orthodox journal would be, and far less troublesome. It is hardly necessary to say that the totals of the analysis columns must agree with the total of the first column—the amount

of invoices. The process column is for the purposes of the cost accounts only.

Posting of Invoices.—The invoices are posted to the credit of the vendors individually, and this should be done, for such as are passed and placed in the book, by the ledger clerk daily. The analysis columns are only posted to the debit of the various expenditure accounts in their monthly totals. All this is ordinary bookkeeping, but with an invoice book properly arranged, and judiciously handled, much more information may be obtained than is usually supplied. The first point to be considered is the amount of detail intended to be given in the trading account of the firm. If the purchases of various kinds, such as iron and steel, forgings, smiths' iron, are therein to be separately specified, then columns must be provided for each class. In any case there must be provision made for such charges as freight, rates, taxes and insurance, and royalties; and also for capital expenditure of the nature of new machinery or tools. But apart from the trading account, and even where the total purchases are therein stated in one sum, it is convenient for the directors and manager to be able readily to ascertain the amount of their expenditure on the various classes of material.

We are, however, supposing a stores department to be in existence, and most of the invoices to be debited to the storekeeper, and credit given him for his issues, the difference between the two amounts at any date representing, approximately, the value of the stores on hand. Several of these analysis columns will, therefore, be debited to stores account, and the most satisfactory method of making the entries is to treat them individually, and not to run the risk of clerical errors by summarising them in one item. The debit ledger entries will, therefore, be as follow :—

Dr.

STORES ACCOUNT.

			Invoice Book.			
Jan. 31	To Purchases—Iron and Steel.. ...		19	256	7	4
" "	" do. Forgings		"	103	17	2
" "	" do. Smiths' Iron		"	46	5	1
" "	" do. Timber		"	10	16	0
" "	" do. Sundry Stores.....		"	135	17	4
" "	" do. Freight & Cartage ..		"	16	5	6

This disposes of the majority of the columns in our model invoice book; the others do not affect the stores accounts, and will therefore be posted direct to the expenditure accounts in the ledger; the new machinery to machinery (capital) account, the new tools to loose tools (capital) account, and the rent, rates, and insurances, and royalties and legal expenditure to the accounts bearing those headings.

Our readers will perceive that we thus obtain a thorough check on the stores account, and can also, by a summary of twelve lines only, ascertain the money value of iron and steel, forgings, or smiths' iron purchased during the twelve months.

It will be observed that all freight and cartage is debited to stores account. This is necessary for costing purposes. Carriage forms part of the cost of goods purchased, and should, whenever it can be earmarked, be included in the issue price. Part of the freight may, however, be for capital expenditure, the materials for which do not pass through the stores books. Such carriage should be at once debited in the stores issue book to capital account, particulars being given of the goods to which it refers. By this method we can readily ascertain the total amount of carriage and cartage for the twelve months, a result which could not be arrived at without considerable difficulty if part of it were debited direct to a capital expenditure account (new machinery, for instance) through the invoice book.

It may possibly be said that the same information may be obtained from the stores ledger, but when the minute subdivisions of this ledger are considered, when it is remembered that such a class as smiths' iron will be there divided into a dozen accounts, according to sizes, it will be apparent that the use of the columnar method may be made of considerable service to the engineering manager, whilst at the same time saving clerical labour.

Stores Ledger.—There is, however, another posting to be done, and another or subsidiary ledger to be kept, and this ledger must agree in total, though not in detail, with the stores account in the general ledger. It is usually kept as a single-entry book, but it may be readily arranged on a double-entry plan, and the additional accounts and entries for effecting this can be made by any practical bookkeeper. There is, however, no necessity for such complication. It

may be recommended by egotistical professional accountants and professional auditors who desire to magnify their office, and imperfectly understand the business they are auditing, but it will increase the work of the clerkly class, and add to the cost of the unremunerative workers. The totals of the stores received and issued books can be compared by the accountant with his stores account in the general ledger, and should agree therewith. If the entries from these into the stores ledger are correctly made, it is evident that the total balances of the latter at any given date should agree with the financial stores account.

The work of keeping the stores ledger, and subsequent references to it, will be greatly facilitated by having it specially ruled. Indeed, this is almost imperative when the storekeeper is not a trained accountant. Some store ledgers are exceedingly elaborate in their accumulated varied columns, whilst others possess only the sweet simplicity of a cash ledger. We have found the foregoing to be a happy and workable compromise between these two extremes.

At the moment we are concerned only with the receipt side of the ledger, and this must be posted from the stores received book, and not from the invoices or delivery notes. This will ensure agreement (subject, of course, to the detection and correction of clerical errors) with the accountant's ledger in the general office.

Invoices not Rendered.—It must have occurred to our readers that there is one difficulty in the stores received book which has not been dealt with. There must always be a gap between the end of the month and the closing of the invoice book for the month, arising from the fact that in no business can all invoices be obtained from the vendors by, or on, the last day of the month. In some cases indeed, particularly with sub-contractors who are both workmen and masters, the delay is very great, and it is often difficult to obtain invoices until many months after the goods or services are rendered. The accountant may, however, do much to obviate this trouble if he will press for prompt rendering of invoices, more especially directing his attention to those from the smaller and dilatory people. But whatever precautions are taken there will always be some goods entered in the stores received book, the invoiced particulars of which cannot be completed before that book, and the general office invoice

book, are closed for the month. When, therefore, the invoices are received, the entries in the stores received book *should be completed in red ink, and an entry made in the current month in black ink* so as to be included in the monthly total of the amount column, as under :—

Goods entered in January from John Storm ...	£13	4	6
„ February „ Eleazer Warlow	1	4	3

By this device the monthly totals of the invoice book and stores received book will agree, whilst the storekeeper will still have details, in chronological order, of all the goods he receives. Of course the ledger pastings must be completed by him at the same time, and also any entries of issues which are waiting the invoices in order to enter the values.

Payment of Accounts.—The invoices for goods received have been examined, and charged either directly to various expenditure accounts, or to the storekeeper for him to debit to sundry contracts when the goods are issued, and on the other hand have been credited to the personal accounts of the parties from whom they are received. These personal accounts have now to be cleared by entries from the cash book, that is, by the posting of payments of the amounts to the parties to whom they are owing. It must be clearly understood that the examination and certification of every invoice must be completed, and the invoice itself be pasted in the guard book before it is paid. When a payment has to be made before the debit has been finally accepted as correct, it must be treated as a “payment on account,” and so marked in the monthly list of creditors submitted to the board, and in all such cases care must be taken to retain a sufficient reserve to amply protect the purchasing firm. It has been seen that all stores and materials should be purchased under authority of the board. It is equally important that for all payments the same sanction should be obtained, and to ensure this a board meeting, or meeting of the finance committee, should be held on a fixed date each month, at which a list of accounts becoming due shall be presented to the directors. It is convenient, in considering this list, to review the officers preparing it.

The Accountant.—The position and authority of the accountant will depend greatly on his relationship to the secretary and general manager. If the secretary has

charge of the whole of the financial books and accounts of the company, in addition to his exclusively secretarial duties, then the accountant will frequently degenerate into a mere bookkeeper, acting entirely on the directions of the secretary, and possessing no initiative authority himself. On the other hand, if the manager supervises all the office arrangements excepting the secretary's own special office, the accountant will probably enjoy greater latitude in his work; and have more responsibility thrust upon him. The division of work varies considerably under different circumstances; the accountant of a small general workshop in a country town is vastly inferior, not only in salary and social position, but also in official influence, to a like-named clerk on a large railway system, or at one of the large shipbuilding, locomotive, or textile machinery establishments of the country. He has much the same clerical work to perform, but he is certainly not permitted the same range of initiation or criticism. There are, however, some general principles which must guide the selection and work of every accountant whether the factory be a large one, or merely an improvised shed with a dozen or two workmen in it. He must, of course, be a thoroughly qualified bookkeeper, not merely able to correctly follow any system laid down for guidance, but also capable of inaugurating a new or improved system if the necessity should arise. He must understand the theory, as well as the practice, of double entry; must be capable of building up nominal accounts in such manner as to turn single into double entry books; and must exercise such discipline in his office as will ensure each day's work being cleared off before the office is closed at night. He must also keep a close supervision over the officers and clerks holding a position quasi-independent but subordinate to him, on the cashier, the storekeeper, timekeepers, and warehousemen, and see that their work is daily kept up to its proper status. Such a system is only a matter of routine; bank tellers have to balance their cash and books each night before they leave the premises, and this involves the completion of the day's transactions; there is no greater difficulty in an engineering firm's "records" being so completed, if the accountant insists upon it, and the staff is sufficient for the work.

For purposes of discipline, as well as of account, he should be the chief of the general office staff, reporting to his immediate superior, *i.e.*, the secretary or manager, any

irregularities which may arise. He should, as part of his daily work, and not at irregular intervals, check the entries of his assistants, and also of the storekeeper and timekeeper so far as to see that they are in exact conformity with the system of the firm. The cashier's receipts and payments should be checked, either by the secretary or accountant, daily into the cash book. It is true this will be done by the auditor and his clerks when they examine the books, monthly or half-yearly as the case may be, but it is important to verify all cash transactions as soon as possible after they occur, and any additional examination is a further safeguard against irregularity or fraud. Of course, it must be understood that the accountant has no authority to give directions to the cashier in the matter of payments, all such instructions coming direct from the board, or, in case of emergency, from the manager or secretary. His relation to the cashier will be strictly critical, and in the nature of a preliminary or internal audit.

The Cashier.—The cashier should always be an officer distinct from the accountant or bookkeeper. In small firms the cash duties are frequently undertaken by the secretary, but there is an obvious objection to this in the absence which it creates of any internal control. No inferior officer in the service of the company can be empowered to supervise the secretary, whose authority and dignity as the representative of the directors must always remain unimpaired. Whenever the magnitude of the work will permit it, a clerk of thoroughly reliable character should be appointed cashier, and confined strictly to his own proper duties of receiving and paying cash, cheques, drafts, and bills of exchange. It is not necessary that he should be a clerk of commanding ability, but strict integrity, sobriety, methodical habits, and correctness in his work are essential. He should not make any payment or advance of cash, not even to a director or the general manager, without due authority, or without obtaining a receipt; and he should immediately record in his cash book all cash he receives or pays, unless it be advances for wages or expenses, which are temporarily treated as cash on hand. A rough cash book is sometimes kept into which the receipts and payments are hastily entered as they are made, and from this rough book the permanent cash book is entered up in the course of the day as opportunities occur. There are both advantages and disadvantages in

this plan, but the latter are usually greater than the former; when, however, it is adopted, an imperative rule should be made that the permanent cash book be entered up before the close of the day, and that this book, and not the rough one, be balanced each night with the cash in hand.

Selection of Cashier.—It will be seen that the appointment of cashier is peculiarly one which may be filled up by promotion of some member of the staff, who by past industry and integrity has proved himself worthy of it. Such a man will be better than an outsider, for his character will be known to his principals, and his conduct will have satisfied their prior scrutiny. The salary should be a sufficient one to induce continuance in honesty, and the position will thus become a coveted one in the office. Where lady clerks are employed, they will generally be found, from their steady and regular habits, and strict conformity to rule and discipline, admirably qualified for cashiers, although they are generally quite unfitted for the more responsible and exacting duties of accountant. Such an appointment will, however, entail greater supervision than with a male cashier, and, in other ways, requires much consideration before it is made. Some engineering firms, who formerly engaged lady clerks, have now dispensed with them, finding the disadvantages attending their employment greater than the advantages.

Monthly List of Creditors.—These two officers, the accountant and the cashier, will be immediately concerned in the preparation of the monthly list of creditors for the board, and in carrying out the board's instructions thereon. Some directors require such elaborate returns of financial matters as utterly defeat their object; their very complexity prevents examination, and the entire statement is passed, for payment of accounts, or as the case may be, on the mere assurance of some official that it is all right. At the present we are dealing only with creditors, a list of whom must be prepared from the personal ledger. We strongly recommend this being written in a separate book, or on separate sheets to the list of debtors, as the journal form is perplexing to directors who are not very proficient in bookkeeping. In addition to the amounts owing to ordinary trade creditors appearing in the personal ledger, the list should include the bank overdraft, if any, and interest, rents, rates, and temporary loans owing and accruing due for payment. The wages estimated for pay-

LEDGER BALANCES.—CREDITORS.

Ledger Folio.	Names.	January.	Due for payment.	February.	Due for payment.	March.	Due for payment.
	Total of Trade Creditors....						
	L. & B. Bank Limited						
	Poor Rate						
	A. B. Loan.....						
	&c., &c.						
	Wages						
	Bills payable						
	Total of Creditors.....						

SUMMARY.

January. February. March.

Cheques required

Amounts to carry forward

Total (to agree with above }
total of Creditors)

Examined

{	.....Accountant.
	.....General Manager,

ment up to the date of the next monthly board should also be added, and also all bills payable falling due within the like period. But such a list, without any further note or explanation, would prove misleading unless all goods were purchased on the same terms as to date of payment; as these vary, and sometimes considerably vary, it is needful to make a note of the day when payment falls due. It is convenient to make a total at the end of the trade creditors, adding the other amounts below, and making a grand total at the foot. If a book is used it may be ruled to serve for three months or six months, and thus save a little clerical work, as well as affording a ready means of comparison between one month and another. This, however, is solely a matter of convenience, and while distinctly advantageous in one place will prove equally inconvenient in another. The form given on page 59 is a suitable one.

Sanction by Directors.—The directors have a very onerous duty to perform when this list is placed before them. They have to assure themselves that the payments they are asked to sanction, and which during the meeting they do sanction, are correct so far as they can ascertain by the exercise of “reasonable care and prudence.” Their responsibility in this respect may not be very patent to many directors, but it is very real, and will be surely brought home to them in the event of legal proceedings arising. But reasonable care and prudence do not mean the checking of every calculation, or of every description in an invoice, nor the weighing or measuring by the directors themselves of every article included in it. These are duties which they employ clerks and storekeepers to discharge, and for which they pay them wages in exactly the same way as they pay the blacksmith for smithing a piece of iron. But it does mean such supervision and control as will ensure a reliable system of examination being adopted and enforced. And this is not a difficult task, if only directors will take the trouble to attend to the work they have undertaken. Either the day previous to the board meeting, or early on the same day, one of the directors (they may take it by rota) should compare the list with the invoices in the guard book, initialing both the invoice and the list at the same time. When the board pass the accounts for payment some distinctive mark should be made in order that the cashier may know what cheques he is authorised to draw. A record of the payments thus

sanctioned should also appear in the minutes, and although this may appear a useless multiplication of records and clerical work, the advantage of it will be apparent in case of any after dispute among the directors.

Drawing of Cheques.—We assume that all payments, with the exception of petty cash payments, wages, and travelling expenses, will be made by means of the firm's own cheques. Payments in cash, or by transfer of cheques or bills received, are exceedingly objectionable, and the small sum thereby saved in bank commission is infinitesimal in comparison to the risk of error, and even fraud, involved. It has also the advantage of preventing an accumulation of cash in the office. All monies received by the cashier can, and should be, banked either the day of receipt or, at latest, the following day. If, therefore, our assumption is correct, the next step is for the cashier to write out the cheques which have been sanctioned.

Form of Cheque.—Various special forms of cheques have been adopted both by large private firms and by joint-stock companies. The ordinary form of bankers cheque may be used, and in such case the following wording should be either printed or stamped with a rubber stamp thereon :—

FOR AND ON BEHALF OF THE CLYDESDALE ENGINEERING
COMPANY LIMITED.

..... } Directors.
..... }

.....Secretary.

The following form, which was invented many years ago by the audit office of one of the large English railway companies, is, however, a much better one, and prevents any tampering with the amounts written on cheques, as the bankers are advised direct of them, and compare the receipts presented with the list they hold.

THE CLYDESDALE ENGINEERING CO. LIMITED.

No..... Vulcan Works, Hopetown,
.....189...

*This advice must not be detached
from the receipt.*

To Messrs. RINGWOOD AND Co.,
Sheffield,

Inland
Revenue
Stamp.
Id.

Dear Sirs,

THE UNION BANK OF LONDON LIMITED, Chancery
Lane, London, has been instructed to pay you the
amount named on the annexed receipt, on your
presenting the same duly stamped and signed.

.....Secretary.

No.....189...

Received from THE CLYDESDALE ENGINEERING COM-
PANY LIMITED the sum of.....pounds
.....shillings and.....pence
in settlement of our account for.....
.....
.....

£ : :

Penny
Receipt
Stamp.

The blanks must be filled in by the cashier before
the advice or cheque is presented to the secretary for
signature.

The real authority to the bankers for payment of the
money is contained in the advice sent them, and which
should reach them before the notices to the payees are

sent out. It should be signed by two directors and the secretary the same as the ordinary, or banker's cheque, would be.

THE CLYDESDALE ENGINEERING CO. LIMITED.

Vulcan Works, Hopetown.

.....189...

To the UNION BANK OF LONDON LIMITED,
Chancery Lane, London.

We have this day passed the following [fourteen] accounts for payment, and you will pay the amounts named to the several firms specified, on presentation of our letters of advice, with the receipts attached duly signed by them, and debit same to our current account.

For and on behalf of the CLYDESDALE ENGINEERING COMPANY LIMITED.

..... } Directors.
..... }
..... Secretary.

No. of Advice.	Name.	Address.	Amount.		

A third method, which is really a modification of the last, is sometimes adopted, but as it lacks the independent advice to the bankers it does not possess the same elements of safety. It has also the disadvantage of not bringing before the directors the amounts for which they are signing cheques so graphically as the second plan, and it affords greater facility for passing the cheques from hand to hand. It, however, gives less trouble to the bank tellers, and will therefore be preferred by them. It is usually in the following, or some similar style:—

THE CLYDESDALE ENGINEERING CO. LIMITED.

No..... Vulcan Works, Hopetown.
189...

*This order must not be detached
 from the receipt.*

To the UNION BANK OF LONDON LIMITED,
 Chancery Lane, London.

Inland
 Revenue
 Stamp.
 1d

Pay to.....

or order, the sum named in the receipt below, on its
 presentation, duly signed by them.

For and on behalf of

The CLYDESDALE ENGINEERING CO. LIMITED.

..... } Directors.
 }
Secretary.

No.....189...

Received from THE CLYDESDALE ENGINEERING COM-
 PANY LIMITED the sum ofpounds
 shillings andpence,
 in settlement of our account.

£ : :

Penny.
 Receipt
 Stamp.

In preparing the list of stores required for submission to the monthly board, provision was made for reporting to the directors any ordered in the interim between the meetings under the authority of the manager. In like manner cheques will at times be drawn and payments made for goods purchased on immediate terms of payment without the sanction of the board being first obtained, or for

other urgent needs. This can, however, only be done under the authority of at least one director, even in cases where cheques are signed by one director only and the secretary, or under the authority of two directors where the general rule of signature is adopted. All such payments should, however, be confirmed by the board, and the confirmation entered on the minutes. For the purpose of this report a separate sheet, or page of the book, may be used, or the amounts may be entered on the ordinary list of the ledger balances—creditors—and in the column, due for payment, a remark made in *Red ink* “paid on.....”

Vouchers.—After the cheques have been prepared and signed, they must be sent out by the cashier, accompanied by a letter, the greater part of which may be printed, leaving only such blanks as the amount and details of payment to be filled in. There is no difficulty in the cashier doing this; indeed he will require to have the necessary information in order to complete the forms of receipts he sends out. Monthly statements are usually forwarded by the vendor firms in addition to, or as summaries of, their invoices, and these statements after being checked, corrected, and reduced by cash discounts in the accountant's office, should be passed to the cashier. If no statement has been received for an account passed by the directors for payment, then a memorandum giving these particulars of it must be made out in the accountant's office.

The letters forwarding cheques should be copied in the cashier's letter book. He will have very few other letters to write, but it is convenient for him to have them all at hand for reference.

If receipts attached to the cheques are employed they should, when received back, be pasted on to the counterfoil cheques. Other receipts (they will not be many) must be placed in a guard book in date order. Where receipts are taken apart from the cheques, they should be placed in a guard book in date order, whilst the cheques returned by the bankers should be fastened to the counterfoils.

Some cashiers number their vouchers consecutively to agree with the entries in the cash book, and many accountant's text books recommend this plan. There is not the least necessity for it. No auditor can have any difficulty in tracing vouchers filed in date order. If, however, the cashier has not sufficient work otherwise to occupy his time there can no harm in thus employing himself.

Petty Cash.—For petty cash transactions a separate book should be used whether the petty cash is disbursed by the firm's cashier, or by a subordinate clerk. By far the most simple and effective plan is to set apart a fixed sum for petty cash at the commencement of the month ; and to make an analysis of such payments, and charge them through the credit side of the cash book at the close of the month. When an amount equal to the sum of such analysis is transferred from general cash to petty cash the latter will be restored to the amount at which it originally stood. This will obviate the necessity for a "Petty Cash Ledger Account," but whether it be adopted, or the ledger form be used, the monthly analysis should be insisted upon, so that the proper expenditure accounts may be debited.

CHAPTER VII.

COST ACCOUNTS. RECAPITULATION OF ARRANGEMENTS FOR PURCHASES.

Cost Accounts.—No system of bookkeeping can be satisfactory in an engineering factory which does not lead up to, and permit the preparation of, detailed cost accounts. Many lectures have been delivered, and treatises written by professional accountants, indicating methods by which this may be done, but nearly all are complicated by interlocking the financial books with the cost accounts, a complication which generally results in rendering the former more abstruse, whilst limiting the detailed information to be gained from the latter. The first effort, with which we are acquainted, to grapple with the subject on these lines was the excellent treatise on "Factory Accounts: their Principle and Practice," by Messrs. Emile Garcke and J. M. Fells, published in 1887, and of which a revised edition has recently been issued. Although we differ in many respects from Messrs. Garcke and Fells, we must express our admiration for the honest and laborious manner in which they have endeavoured to solve a very difficult problem; if they have not entirely succeeded, they have at least explained its intricateness, and insisted upon the necessity for correct and scientific method, if the cost accounts are to be of any practical value. Probably the failure which most public accountants make in dealing with this matter arises from their utter ignorance of the requirements of engineers, and of the purposes for which cost accounts are used. That they should balance with the financial books is beyond dispute, for such agreement is necessary to prove their correctness, but that they should be interlocked therewith, and form part thereof, though an endless succession of subsidiary ledgers and transfer books and journals, is surely discarding their primary intention. The very perfection of such a system, when, by great expenditure of clerical labour it is fully carried out, will introduce such rigidity of results as will deprive them of much of their value. The necessities of the engineer

THE IMPERIAL SPINNING

TRADING ACCOUNT FOR YEAR

1897.			
Jan. 1.	To Stock—Cotton		
	Yarn, &c.		
Dec. 31.	„ Purchases—Cotton		
	Yarn, &c.		
	„ Discount		
	„ Paper		
	„ Petty Cash		
	„ Wages		
	„ General Repairs		
	„ Tie Yarn		
	„ Carriage		
	„ Cases		
	„ Waste		
	„ Salaries		
	„ Subscriptions		
	„ Charges		
	„ Stationery		
	„ Timber		
	„ Packing		
	„ Rates and Taxes		
	„ Gas		
	„ Water		
	„ Coal		
	„ Tube		
	„ Sundries		
	„ Oil		
	„ Roller Covering		
	„ Cleaning Waste		
	„ Banding		
	„ Bobbin and Skewer		
	„ Boiler Repairs		
	„ Shafting do.		
	„ Cardroom Repairs		
	„ Engine do.		
	„ Spinning do.		
	„ Leather		
	„ Interest		
	„ Mechanics' Repairs		
	„ Chief Rent		
	„ Brush		
	„ Cardroom Brush		
	„ Machinery		
	„ Twine		
	„ Skip		
	„ Depreciation of Buildings and Machinery		
	„ Profit, transferred to Profit and Loss Account		
		£	

COST ACCOUNTS:

COMPANY LIMITED.

ENDING DECEMBER 31ST, 1897.

[illegible]

demand that he shall be able to revise and alter his "costings" without introducing confusion and anarchy into the accounts of the company.

Nature of Cost Accounts.—It is well to consider what it is the engineer really requires for his own guidance, and in what respects it differs from the information which the directors must supply to the shareholders, or to the official receiver in the event of an unfortunate ending to the career of the firm. The latter consists chiefly of a statement of the total amount of material purchased, of the salaries and wages expended in working it, and of the general stores and management expenses incurred in carrying on the business, on the one hand, and on the other of a summary of the amount received from sales of finished products, and of other sundry receipts obtained from sale or hire of the company's assets. This will be readily understood from the accompanying example of the trading account of a textile mill.

Now it is difficult to imagine a trade account more detailed than this, and equally impossible to conceive its serving any purpose for which engineers use detailed cost accounts. This account deals with everything in the aggregate, and displays no proportion between any of the individual debits and any item of production, or even any process of manufacture. Spinners do arrive at such knowledge, it is true, but it is by a different method, and based on different observations of data, to that on which the trade account is founded.

The engineer's requirements are much greater than the spinner's; his business is more complex and varied, and the opportunities for financial blunders are much greater. Whilst the spinner, knowing the cost and selling price of 32's twist, can instinctively arrive at the analogous figures for 40's, 50's, or 60's twist, the engineer can find no natural analogy between either cost or selling price of a steam hammer and a screw-cutting lathe, both of which are produced in his establishment. To be on equal terms for the financial management of his business with the textile manufacturer, he must incur greater trouble in compiling his costs.

Division of Cost Accounts.—The information required is of a threefold nature, the first of which may be arranged for in the ordinary ledger, but only by the sacrifice of other particulars which are generally deemed essential for

ordinary bookkeeping purposes, or by the use of transfer entries, which greatly increase the work of, and perplex and worry the bookkeeper. The three divisions are :—

(A) The cost of the various departments, such as offices, mould loft, joiners, blacksmiths, fitters, labourers, &c.

(B) The cost of the various portions of a machine or engine, such as cylinders, cylinder coverings, pistons, connecting rods, crankshaft, boiler shell, boiler tubes, boiler fittings, &c., &c.

(C) The total cost of each separate contract as it is completed and ready for delivery to the purchaser.

It is also desirable always, and in some cases it is absolutely imperative, that the directors and general manager should be able to ascertain the profit or loss of each department considered as an independent concern, and selling its productions to the firm, or to other departments of the firm, at current market prices.

All this cannot be worked out on one sheet or on one set of sheets; the results may be thrown into diagrammatic form eventually, but their compilation week by week is tedious work, and demands much paper and patience. The most satisfactory and practical method is to adopt the threefold division into—

Form A for departmental accounts,

Form B for process accounts,

Form C for contract accounts,

which will lead from one to the other in natural sequence.

Invoice Debits to Cost Accounts.—At present we have only to consider debits which arise directly in the invoice book: by far the greater proportion of the costs debits will, however, arise in a subsequent stage of the transactions, when various materials are issued by the storekeeper, or when labour is expended on their manipulation, which is paid for through the wages book. It will be observed that in the form of invoice guard book already given there is a column headed “process.” By this term process is meant the sub-division of a contract, an engine, a machine, or even one piece of work, such as a length of shafting, into such component parts or classes of labour as the manager may deem needful to be separately stated for his information. But in the invoice book it has a supplementary signification, and is used to indicate the department, or contract, or service to which the invoice is to be charged in the cost

sheets. Thus, in three invoices for iron from the Dowlais Iron Company, the first being in compliance with an order prepared in the drawing office for the shell of boiler No. — will be entered (in the process column) to that contract, the second, being for smiths' iron, will be entered to stores department, while the third, for iron for roofing of a new shed, will be entered to capital account. Again an invoice for iron and steel received from another firm contains iron for two separate contracts, specially ordered for them, and a third lot for general consumption in the yard; these three lots must be dissected and apportioned in separate amounts in the process column. In like manner invoices, or portions of invoices, will appear for new machinery, and new tools which must be entered to capital account, and for rents, rates, insurances, legal expenses, and other charges which must be entered to management expenses in the process column.

This arrangement may be modified so far as to pass all stores ordered for contracts through the storekeeper's books, and this is by many accountants considered the better plan in any establishment dealing with work of minor dimensions, as machine tools and electrical plant. For bridge construction, shipbuilding, tankmaking, and work of that description, it is more convenient to charge the specially-ordered material to the contract, both in the financial books and the costs accounts, carefully notifying the storekeeper in each instance of this being done. In all cases, however, the capital charges and management expenses should be collected from the invoice book, and not passed through the stores account.

When the accountant, or the cost accountant when a special clerk is detailed off for that purpose, is preparing his several "A" cost accounts, he will enter on the debit side all the invoices, as they are marked in the process column. It is, however, evident that the boiler plates marked to Contract No. — cannot be charged immediately to that contract, for in that case the debit would go direct to the "C" sheet, which is to show the completed cost of the entire work, and would be deposited metaphorically on a sort of Tom Tiddler's ground, being in no man's particular charge. His first care, therefore, must be to consider which department will commence operations on the material in question—in the case instanced it will be the boilermakers—and then to charge it to that department, but for the special contract for which it was ordered. The material in question

will thenceforward be in charge of the foreman of the boilermakers, or other trade affected, who will be responsible for its being used for the purpose for which it was ordered, and for no other.

Freight and Cartage.—In the model form of invoice book there is a column for freight and cartage. Railway invoices are, however, frequently so voluminous, and troublesome to check, that it is better to keep a special guard book for them into which they can be pasted flat. The analysis of them is very troublesome, especially for detailed cost accounts, if averages and percentages are to be abolished or reduced to a minimum. It is evident that the carriage on such material as is ordered for new buildings or machinery, or extension of the works, should be charged at once to capital account. It is part of the cost incurred in increasing the value of the premises, and should no more be debited to revenue account than should the iron used in the erection, or the wages paid for putting it up. In like manner the carriage on plates, angles, and girders, specially ordered for and charged direct to such constructions as bridges or ships, should be debited to the same contract or process. It is not, however, quite so clear what is to be done with the carriage on general goods which pass through the storekeeper's hands, and the difficulty is increased by the fact that such charges form the greater part of the carriers' accounts against a mechanical engineering firm. The cost of an article is the invoice price of it plus the amount which has to be paid for delivery at the works, and on the cost thus arrived at, the issue price of it by the storekeeper should be based. The carrier's invoice will be passed through the storekeeper's received book (less the proportion of it charged direct to capital or contract accounts), but will be divided so as to show each class of goods comprised in it. The example on the following page will perhaps better explain the entries to be made in the stores received book.

These items will, of course, be posted in the stores ledger, to the same accounts as the vendors' invoices, for the stores, and therefore increase the issue price of the stores by the amount of the freight. Undoubtedly there is a considerable amount of labour involved in this method, but it eliminates one of the charges which, in some firms, is passed into general expenses and other like accounts, which are averaged over the ordinary expenditure accounts

Date.	From whom received.	Order No.	Description of Stores.	No. received.	Weight received, Cwt. Qrs. Lbs.	INVOICED.				
						No.	Weight. Cwt. Qrs. Lbs.	Price	Amount. £ s. d.	
1898. Jan. 30	Caledonian Railway.	...	$\frac{3}{8}$ in. Rivets.	...	...	...	10	...	1/-	0 10 0
						...	20	...	1/-	1 0 0
						...	20	...	1/-	1 0 0
						...	Tns 73	...	6/8	24 6 8
			Plates, ex Coat-bridge Iron Co.	...	...	...	

as divisible charges. It is always desirable to reduce these averages as much as possible in accounts; they are frequently misleading, and invariably afford a loophole for getting quit of an obscure charge without ascertaining what it is really for.

But railway and other carriers' accounts demand much more careful attention than is necessary for a correct record and disposition of them in the books. Rightly or wrongly the railway companies have obtained an unenviable character for making overcharges in their bills, and endeavouring to introduce rates which are not justified by the conditions of the traffic, nor even, in all cases, authorised by their parliamentary tolls. Sometimes these complaints arise through pure misunderstanding; the railway classifications are very intricate, the exceptions and variations are numerous, and freighters feel aggrieved at charges which they imagine are excessive and incorrect, when the real difficulty is that the rate book, or some of the exceptions in it, have not been properly interpreted by them. It is therefore desirable that one clerk in the office should be specially trained to keep a record of all railway rates affecting the firm, and to note all alterations made therein; and that this clerk should be charged with the duty of checking all railway accounts rendered. It will be necessary to refer to the orders given to ascertain that materials has not been consigned "carriage forward" when purchased delivered at the works, but errors of this kind are few in comparison with those which arise through the charging of incorrect rates.

The best form of rate book is that used by the railway companies themselves, ruled with columns for the various classes and with a space for special and exceptional rates. The stations should be arranged in the order they stand on the several railways, as in a Bradshaw's guide, and not alphabetically. This facilitates comparison of the companies' charges from various districts, and greatly assists the freighters in presenting their claims for reduction of any unequal rates which press unfairly on a particular district, and hamper its traffic. The anomalies are not so numerous now as formerly, but they still exist, and arise almost automatically through changing conditions of localities, and consequent diversion of traffic.

Temporary and Branch Establishments.—The branch establishments of railway and building contractors, ship-builders, &c., have been incidentally mentioned. These

differ from the separate works confederated under one board, worked under almost independent management, and keeping their own individual accounts, which are sometimes found in the great modern "trusts" or "combines." The branches to which we refer are temporary in character, without any fixed plant, and usually supplied with an imperfect and inefficient office staff. The accounts should be made as simple as possible, subject to the maintenance of an efficient check on the expenditure.

The best plan is to treat the branch as a department, and debit it with all materials and money sent to it, in exactly the same way as stores are debited to the stores department. The foreman in charge of the branch will have to account for this cash and material in his weekly wages sheet, and his monthly returns to the head office. The wages sheet will be in the form adopted at the home establishment; any other cash spent will be accounted for in a petty cash return to the cashier at the close of the month; and the stores and material consumed will be exhibited in a monthly statement similar to that made by the storekeeper to the accountant, as hereafter explained. The only books necessary will be a cash book, a stores received book, and a stores issue book, with perhaps a stores ledger if the branch is a large one, or a lengthy period of time has to be occupied in the work.

But the control of such a branch requires much more than bookkeeping; it demands on the part of the foreman, though on a smaller scale, much the same qualities as make the efficient general manager or works manager. He has to anticipate his requirements, to see that his local storekeeper sends proper demands for them, to superintend the inspection of all materials received, much of which will come direct from the vendors, and to examine and certify all invoices before they are sent to head office for payment. On a smaller scale, he has himself to perform the various duties of several officers at the home works, and must of necessity become a sort of miniature "Admirable Crichton." It is evident that the selection of such a superintendent requires the greatest care and consideration on the part of the directors and general manager; it is not every shop foreman who will creditably fill the post.

Recapitulation.—The commercial management of an engineering establishment may be separated into two great divisions, purchases and sales; and to superintend

these operations there are officers of various degrees, each with distinct duties to perform, but all working for the prosperity of the company, from the directors, secretary, and manager down to the timekeeper and gatekeeper. The orders for purchases are issued in pursuance of requisitions from the drawing office or storekeeper, submitted through the general manager to the board of directors for their sanction. The placing of the order with any particular firm or firms is determined by the manager, who is in general guided by the consideration of buying in the cheapest market; the *cheapness* being, however, determined by consideration of relative qualities supplied by competing firms, as well as by the lowest price. After an order for supplies has been issued it is necessary to inspect the goods furnished in response, sometimes during the progress of their constructions, and always on receipt at the works; and this inspection is occasionally of so technical a nature that it can only be properly discharged by duly qualified engineers. The storekeeper, when the goods are accepted for use, at once records them in his stores received book, which is so ruled that he can complete the entry with the purchase cost of the goods, when the vendors' and carriers' invoices are handed to him for examination and certification. The invoices for goods purchased or charges incurred are subjected to a minute examination, as indicated by a stamp or label placed thereon in the general office, and are finally submitted to the board, certified by the manager and a director, for their payment to be sanctioned. These payments should all be made by cheque on the bankers of the firm, and although several forms of cheques may be adopted, one which gives to the bankers a direct and independent notification of the amount to be paid is preferable to one more open to alteration. Vouchers for payments have to be obtained by the cashier, and filed by him in date order, whilst petty cash payments have to be analysed by him, and the amounts of such analysis entered in his general cash book at the end of the month. But whilst these systematic arrangements are necessary, or at least desirable, in all commercial concerns, a further development of accounting is needful for the engineer, who has to deal with conditions of increased difficulty and complexity. For this purpose cost accounts are used, prepared from the same subsidiary books as the ledger, but not interlocked therewith; and these cost accounts display, first, the expense of the various

departments; secondly, the expense of the various sections or parts of a machine or engine, &c.; and thirdly, the total cost of the finished contract. An examination of the system of accounts heretofore suggested will show that the directors and manager have in the books of the firm the following varied information always available.

(1.) The estimated value of stores and materials ordered month by month.

(2.) The total amount of invoices rendered to the firm each month, and the same amount divided, as they may direct, into various classes of materials and expenditure.

(3.) The total of the creditors each month, divided into an amount paid or to be paid, and an amount carried forward for future payment.

(4.) A summary of the kind of payments which have been made through petty cash.

(5.) Particulars (through the cost accounts) of the invoices debited to the various departments, thus affording them an additional notification of materials ordered for special contracts as distinguished from general stores.

If the directors have records such as these placed before them, and give proper regard to the lessons they teach, they will possess the means of discharging their responsibilities, with respect to the purchases of the firm, with that "reasonable care and diligence," or prudence, which the law imposes upon them. The manager also, as their chief executive officer, will leave ready means of comparing the purchases at different dates, without the tax on his memory, or the delay and trouble of laborious searches, which lack of system would entail. But this is the mere fringe of "commercial management." Whilst it is undoubtedly necessary to exercise great care in purchasing materials it is chiefly on the manipulation and further evolution of such materials, and on the constant succession of remunerative orders that the profits of the firm will depend. This, therefore, brings us to the second division of our subject, a division which, when completed, is equivalent to the bookkeeper's credit side of his ledger, just as the purchase portion is to the debit side.

CHAPTER VIII.

SALES DEPARTMENT. ADVERTISING, CATALOGUES, TRAVELLERS, &c.

Sales Department.—Steady succession of orders is really a necessity for successful management of engineering works during periods of ordinary business conditions. Special pressure, and the increased prices obtainable under such pressure, may at the time afford enhanced profits to certain branches of the trade, but these profits will disappear if a period of depression should succeed: it is the old story of the lean kine swallowing the fat ones. But all classes of engineering works will not share in this temporary prosperity; the makers of machine tools of standard patterns, who publish catalogues and advertise their prices, cannot revise such quotations each time there is a brisk demand for their particular class of products. There is a commercial advantage in these fixed prices; they enable local agents, travellers, and special representatives to quote with facility, without the delay of references, and without fear of blundering, and these facilities cannot safely be thrown away to snatch an ephemeral advantage in price. Continuity of work, steadiness of employment for his tools, progressive but permanent development of his business—these are the ends which should be kept in view by the engineering factory manager, and to the attainment of which the selling part of the management should constantly be directed.

The business of any firm can only be sustained by constant attention, sometimes taking one form of solicitation and sometimes another, but always bringing its claims before customers and possible customers. The modes are varied: advertising, circulation of catalogues, travellers, personal solicitation, correspondence, and the good reputation of the firm are all employed; but the object of each is the same, to secure new orders for goods or work.

Advertising.—The end sought in advertising is publicity, but it must be publicity of the right kind. It is

useless to recommend slotting machines to shoemakers, or steam hammers to railway porters, although they are both very useful machines to those who require them; and a wise advertiser would therefore not place notices of machinery in a paper read chiefly by such classes of the community. On the other hand it must be remembered that many users of machinery, particularly of machines of the smaller types, do not indulge in trade or technical journals, and have greatly to rely on notices in their own local general paper. Provision must be made for attracting such stray customers, but it must be of an economical nature, since the trade is of an intermittent and uncertain nature.

Indeed, to obtain the full advantage of advertising (by which at present we refer to advertisements in newspapers and magazines), it should be conducted on a carefully-designed plan. Probably the most satisfactory way is to determine, at the commencement of the financial year, the sum to be expended on this service during the coming twelve months; it will vary with the development of the firm, but it should always be remembered that a saving of advertising expenses generally means a much greater reduction in the amount of orders. The total expenditure having been determined, the next consideration must be given to its apportionment. The first place must undoubtedly be given to the technical and trade journals, as these are read by the best class of purchasers, and frequently referred to by occasional purchasers, when they want some particular class of machine, or desire to learn the names and addresses of several makers thereof. But the selection of trade journals should not be a narrow one. Some manufacturers appear to think they have done sufficient if they insert a notice in the paper or papers devoted to the interests of their own particular trade, utterly regardless of those which deal with business of an allied character. A shuttle manufacturer will weekly or monthly announce the excellence and cheapness of his wares in the textile papers, but will deem it an utter waste of effort and money to offer any attractions in the electrical or mechanical engineering papers. And yet the man who reads the one is likely occasionally to see the other, and if he understands it less, to be more impressed by what appears in it. In advertising it is well to remember the ignorance of the average reader, and to take full advantage of it. The shuttle

maker who advertises in an engineering paper undoubtedly exercises a wiser discrimination than one who neglects to do so.

After the trade and technical journals have been satisfied, and only after this has been fully done, provision must be made for the daily or weekly newspapers and magazines of a general character. The selection of the papers will be governed by the character of work done by the firm, and also by its general polity in regard to the districts it will operate: if a local trade is desired, then only local papers will be chosen, both to reduce expense and also because such papers promise the best assistance in obtaining the business wanted. At the present time the weekly illustrated papers, which circulate so largely in country houses, are by many machinists preferred to the daily papers, and the preference appears to be justified. They find their way to a large circle of buyers, and a wet day in the country causes them to be read through, advertisements and all.

Catalogues.—Closely allied to advertising, as limited in the previous paragraph, are the illustrated catalogues now so customary with engineering firms. Some of these are models of artistic skill and delicate engraving, and most of them are very costly to produce. It is therefore necessary to limit the circulation to customers, or probable customers, of the firm. The "probable" customers, however, constitute a difficulty. It is hard to say, when an enquiry comes from a stranger, whether it is merely a curious enquiry, from which there is no possibility of business resulting, or whether it affords fair prospect of a sale being effected. It is unsafe to treat it with pure pessimism, as an order, and possibly a profitable connection, may thereby be lost. On the other hand, sending catalogues to inquirers is a heavy tax on the firm, but it is a tax frequently, and possibly wisely, submitted to in preference to the risk of losing business. Where, however, the standard products of an engineering firm are numerous, and of varied character, something may be done to reduce the expenses by having the catalogues printed and bound in sections, and even by having additional sheets printed for the most prevalent machines, so that the entire list need not be sent in response to every stray enquiry.

It is really important that both the letterpress and

plates in these books should be handsome and artistic work. Some of them, as we have already said, are models of good taste, but others still remain which are a disgrace both to the printers producing and the firms using them. There cannot be any doubt that, in the absence of other factors for judgment, a pretty picture will frequently determine the selection of a machine. The appreciation of this by the better commercial firms is evidenced by their advertisements in the trade and other journals, where they display engravings which appeal quite as much to the eye's appreciation of beauty as to the technical understanding of the constructions. These pictures are frequently enlargements of catalogue plates, and clearly show how greatly the æsthetic cult has invaded our trade methods.

Correctness of detail, both in description and picture, is, however, as necessary as artistic beauty. Possibly this remark is more necessary in relation to foreign catalogues than for those circulated in this country. We have seen engineers' lists sent from this country to Central and South America printed on bad paper, from worn-out type and blocks, and with letterpress incorrect in technical details, although possibly devoid of grammatical blunders; and in rivalry with these the circulars and advertisements of United States firms, on highly-glazed paper, and displaying all the beauties of the printer's art. The bad paper and bad printing are inexcusable; they are parsimonious blunders which lose trade to the issuers of them; but for the errors in translation there is some palliation. The linguists who execute this work seldom understand the trade, or the terms used in connection with it; their translations should, therefore, always be submitted to the revision of an engineer, when one can be obtained, who is sufficiently versed in the language concerned.

Travellers.—Advertisements and circulars have to be followed by further solicitation, if the full benefit of their circulation is to be obtained. In some departments of the trade this is more important than in others, hence the necessity under which some houses labour of employing regular travellers on the road; it is chiefly the question of the wares supplied which determines their use or otherwise. But where these are employed they should be selected for their tact and courtesy, their pertinacity, their alertness, and not for their qualifications as engineers. Of course, it is necessary that they should know something of

machines and other goods they are hawking, sufficient at least to talk about them intelligibly; but is far more needful that they should possess patience, good temper, imperviousness to rebuffs, and that quick insight into character which will enable them to read their customers' characters and detect their foibles. When they are employed they must never be permitted to despair of any ground over which they travel, and must be made clearly to understand that they must sow their seed again and again until they reap the reward of orders.

Collection of Accounts by Travellers.—It is very bad policy to let the duty of collecting country accounts devolve on travellers; it frequently leads to irregularities, and always tends to interfere with their orders. Many Continental manufacturers do not permit their representatives, whether peripatetic or stationary, to receive money on their behalf, except under special circumstances, and the regulation has been found to work well. Accounts are required to be remitted, when due, to head office, and the chief labours of the representative are directed to securing a continuance of them through further orders, and to opening transactions with new customers.

When, however, travellers do collect accounts on their journeys, every possible precaution should be taken against fraud. The statements sent to the customers should be posted direct from the accountant's office, and not handed to the traveller, who should be merely furnished with a list of them. He should be required to remit his collections home daily, or to pay them to the credit of his firm at one of their banker's agencies, and he must not be permitted ever to use such monies for travelling expenses, salary, or other payments. He must daily send the cashier a statement of the amounts he receives, and of the disposal of them, and on this statement he must notify and explain any deductions he allows, in manner following:—

THE CLYDESDALE ENGINEERING CO. LIMITED.

.....1898

I have this day received accounts as follows :—

From Jones and Watson.....	17	9	6
Discount allowed 9s.			
From Evan Daniel.....	272	9	0
Allowed for bad brazing of pipes, as per his letter of.....£7.			
Discount, £13 19s.			
Remitted you per draft on London ...	£289	18	6

DAVID WILLIAMS, REPRESENTATIVE.

The receipts given must be from a numbered counter-foil receipt book, and a notice may be printed across the face of the receipt that a further acknowledgment will be forwarded to the payer, from the head office of the firm, in the manner adopted by one, at least, of the large railway companies. This precaution is, however, of little value, and should not be much relied upon. When a customer pays an account, and obtains a valid receipt for it, he will seldom trouble himself to seek a confirmation of that receipt merely to satisfy the system of the firm. Whether it is possible to limit the discharge given by a collector's receipt is a legal question, but it is certain that no such limitation is imposed by the form at present adopted. When the agent is permitted to collect money, his receipt binds his principal.

Daily Reports.—Daily reports should be required from each traveller. They should be dated at the top from the hotel and town at which he is staying, and should give his anticipated postal address for the next three days, so that letters and telegrams may be forwarded him. This report should state the journey or journeys made during the day; the firms visited, with remarks on their several complaints, enquiries, or expectations of trade; and a list of the orders enclosed. Each order should, for convenience of office record and reference, be written on a separate sheet. The

report should also contain any information the traveller can gather as to the condition of trade in the locality, and the financial condition of any of the traders or manufacturers in it.

There is another point on which the traveller should be encouraged to report freely and fearlessly, although it may not always be pleasant reading to the directors and manager at the works. In his journeys, in his intercourse with his customers, and even in the commercial room of his hotel, he will gather much knowledge of the estimation in which his firm is held, and of the efforts their competitors are making, either by reduced prices, better terms of payment, improved workmanship, or improved designs, to steal away their custom. All this he must carefully and fully report, and, if necessary, repeat again and again, so that if his principals lose their trade it will be through their own folly, and not from his neglecting to warn them.

Personal Solicitation.—The advantage of personal intercourse between the principal and his customers was fully understood in former days, and some of the most prosperous English firms owe much of their early success to attention to this form of courtesy. It derives its force from an inherent quality of human nature, and however manners may change, or methods of business alter, the love of flattery will still remain. Of course it is impossible for the directors or manager of a large modern tool making or agricultural implement works to regularly take a journey as a traveller, but it is not impossible for them to occasionally visit their principal customers.

Much depends on the character of the business: where it consists chiefly of large orders or contracts there is little excuse for neglect of this personal effort, nor is it usually neglected in such cases. Where the business is of a general character, and depends on distribution through retailers, or on numerous small orders from consumers extending over a large area, and which necessitates the constant employment of commercial travellers, it is more difficult for the principals to be induced to take the trouble which it involves. No certain rule, applicable to every case, can be laid down. There is an advantage most certainly in the personal solicitation of the principals. It is for them to judge, in each individual case, how it may be effected without neglect of other, and possibly more important, duties.

Reputation of the Firm.—The good reputation of the firm is a potent agency in procuring orders, but it must be remembered that reputation is of dual character: it is built up by commercial integrity, courtesy, tact, and attention to such office details as correspondence and correctness of accounts, as well as by excellence of workmanship, or quality of materials. These office details are of more importance in a general business, with numerous and widely scattered customers, than in one relying on large contracts or a limited clientele. It is certainly more easy to escape animadversion for neglecting a letter relating to a large railway contract, or a heavy ironclad, than for one referring to a wall pump or a portable drilling machine. Thus it occurs that the smaller firms are handicapped as much by the more onerous obligations imposed upon their office staff, as by the difficulty of sufficiently remunerating that staff so as to keep it thoroughly efficient.

Division of Sales.—It is necessary, however, to consider more particularly the nature of sales, in order to fully appreciate the methods of effecting them. As the business of an engineering firm may be separated into the two great divisions of purchases and sales, so the latter may be further subdivided into sales by standard or list prices and sales by tender or contract, which really amounts to the old fashioned plan of "higgling the market." The sales on list prices depend on the judgment and ability displayed in advertising and distributing catalogues, on the pertinacity of travellers, and on the reputation of the firm for good workmanship, and upright and courteous dealing. The sales on tender or contract involve the preparation of estimates, each one of which requires a more or less careful review of the circumstances of the firm at the particular moment, of the desirability of procuring additional work, and of the limitations under which it will be accepted. But prior to preparing the estimate, or rendering the tender, there is generally some amount of correspondence to be undertaken, and as it is part only of the work of an important department of the general office staff it is convenient to consider the duties of that department in their entirety.

CHAPTER IX.

THE CORRESPONDENT AND HIS DUTIES.

The Correspondent.—The secretary has been referred to as the medium through whom the directors communicate to the shareholders and others the views and decisions of the board. The chief correspondent occupies much the same position with respect to the manager: he is the manager's medium of communication with customers, contractors, enquirers, on all the thousand and one matters which are nowadays made the subject of letters. He holds a confidential position in the office; has access to papers which must be kept inviolate, and can often forecast events which it is not desirable to disclose throughout the works by anticipation. His first and most important qualification is therefore a capacity for secrecy; if he cannot control the "unruly member" all his other acquirements will count for little. Shorthand, of some description or other, is now so usual with the clerkly class that it would be absurd to employ a correspondent who did not use it: but, unfortunately, modern languages, which are equally necessary, are not so frequently known to them. The marked linguistic deficiencies of English clerks have caused the frequent employment of Germans in lieu of them, but the substitution is not altogether satisfactory. We have met the Teuton in all parts of the world, and found him painstaking, hardworking, and clever, but ever and always more careful of his own interests than of his employers', whenever the two conflict. It must be remembered that the youthful clerks who come over to England for experience, and accept abnormally small wages for very useful services, take back to their own friends in Fatherland information which is jealously concealed from all English competitors. In mediæval legends we are told that the gifts of the evil one ended in the disaster of the recipient; the same unfortunate termination frequently follows the employment of the foreign clerk who comes to this country merely to complete his training, and not for permanent residence and occupation.

The most useful languages are German, French, and Spanish; there are now good classes in most large towns for all of them; indeed German and French are frequently taught in the public elementary schools. In all these languages, and more particularly in Spanish, there are modes and forms of technical expression which are not literal translations of English phrases, and neglect of these idiomatic peculiarities may lead to considerable inconvenience. The clerk who has merchantile or technical foreign correspondence to conduct should therefore take a special course of lessons therein, however well versed he may be in the literature of the country.

Authority of the Correspondent.—The position and authority of the correspondent should be carefully and exactly defined. He holds a confidential place in the office, and is apt to usurp an ascendancy therein, and in the works generally, which is not entirely for the benefit of the firm. In a railway traffic office, a manager's chief correspondent is to some extent, and sometimes nominally, his assistant; but it must be remembered that he is much more than a writer of letters from dictation—he is versed in all the details of the working and management of the line, and has to undertake superintendence of men, and arrangements of trains, rates, and supplies, in addition to answering letters. In an engineering or other constructive works, however, the conditions are entirely different. The clerk has to write his letters chiefly from dictation, and seldom has the opportunity or inclination for mastering the details of the business, either on its technical or accountancy side. He is merely a clerk; a trusted one undoubtedly, but of much less official importance than the draughtsman, or even than the accountant.

Registration of Letters.—It is undoubtedly convenient that all letters and telegrams addressed to the firm should be opened by one officer, and one officer only. The secretary appears marked out for this duty by his position as representative of the directors, and by his usual daily attendance at the office. To whomsoever the duty is delegated, however, it is most important that it should receive attention at an early hour in the morning, so that the letters may be ready for the various officers immediately they arrive at the works. One of the correspondents (the chief preferably) should be present at the opening of the letters, so that he may register them, and sort them

into bundles or baskets for distribution to the various departments.

The difficulty of finding papers in a large office after the lapse of a few months is well known, and many elaborate systems of registration and filing have been invented to overcome it. The best form of register is probably one adopted some years ago by Mr. Lapper, of the general manager's office, Euston, an office where 1,000 letters a day were at that time received, and which was found to be convenient, effective, and simple. He used a book alphabetically arranged, as in a ledger index, with a few additional pages for sub-divisions or special writers, and ruled as under :—

Date of Receipt.	Date of Letter.	Name.	Subject.	To whom sent.	File No.

The first four columns explain themselves. When the letter was entered in the register it was stamped with the date of its receipt, and forwarded to the officer to whom it referred, and whose name was then entered in the fifth column. The correspondence on any subject was retained in the office dealing with it until it was completed, all letters on that one matter being pinned together, and it was returned to the registration office for filing in such compilations. When it reached there the next progressive number was stamped thereon, back and front, and this progressive number marked in the last column of the register against every letter in the bundle, no matter what the date of its receipt might be. If any bundle of correspondence was subsequently required by any office, a slip was placed in the rack in lieu of it, giving the register number, the subject, and the name of the clerk or officer removing it.

This system of filing will probably be found cumbersome in an ordinary engineering office, and may be superseded by one or other of the methods mentioned hereafter. In that case the last column of the register—the file

number—may be omitted, but it will still be found an advantage to retain the alphabetical arrangement, and to stamp the letters with date of receipt. We have seen letter registers which contained columns for date of answer, and page of copy letter book, and for date filed, in addition to columns for names of officers lent to, date of return, and remarks. This is useless and wasteful routine. The date of reply to a letter can be marked on the face of it, and a properly indexed letter book is easy and ready of reference. It may be said that this amplified index enables the manager immediately to see what letters are unanswered; but if he has a staff so undisciplined and disloyal as to neglect correspondence, and is therefore compelled to inspect the register to see that his clerks have answered letters, he can hardly be deemed a model chief. He may possess order, loyalty, and energy himself, but he has certainly failed to impress them on his subordinates.

If the received letter register is kept it must contain entries of every letter, telegram, and specification which reaches the office; indeed, drawings, tracings, and trade catalogues should be entered in it under the date of receipt. A metal or rubber stamp should be used for dating the letters as they are registered: rubber stamps are preferable, and cheaper. Important letters and telegrams, where time is of the essence of the matter, should have the time of receipt as well as the date marked on them, *and initialled by the receiving officer.*

Distribution of Letters.—After the letters have been registered, but only after this has been done when a register is kept, they must be distributed to the various departments. Those for the secretary and directors will be sent immediately to the secretary's office (or retained by him if he opens the letters), but the other departmental letters should be placed before the manager for his inspection and remarks before they are distributed. The greater portion of the business correspondence will, however, be dealt with by the correspondent under his direction, or from his dictation. In a well-ordered office all letters received before noon are answered, or at least acknowledged, on the date of receipt, and this can only be done when they are dictated to the correspondent early in the day. We have, therefore, no hesitation in placing prompt attention to his correspondence on his arrival at the work among the most important duties of the manager.

It should take precedence of any inspection he may make of the shops or of contracts in progress.

Letters arriving after noon, or after the early afternoon postal delivery, may be reserved for attention the following day. Urgent letters and telegrams should, however, be acknowledged or answered in some form or other the day of their receipt, whatever time they arrive.

Departmental Letters.—The methods of dealing with correspondence will depend on the size of the works; indeed, as already intimated, many variations will arise in practice between large and small factories. Where the works are of small or moderate size, employing up to 500 or 600 hands, it is undoubtedly better to write all the letters in the manager's or general office. In any case, a considerable proportion of the letters circulated to the departments will be merely for the heads thereof to note them or make their remarks thereon, and these should be promptly returned to the general office to be there further dealt with in accordance with the manager's instructions. There are others, however, to which it is more convenient for the departments to indicate the exact reply to be given, but it is not convenient, nor conducive to the reputation of the firm, for these replies to be written by a subordinate clerk employed for other departmental work, nor is it advisable to impose the duty on the foremen or sub-managers. In such factories it is better for the correspondent (or one of his assistants, if he has any) to visit the various departments with his note book, and take down the dictated answers, or a *précis* of them.

In establishments of greater size and pretensions, where the heads of departments are really managers *de facto*, and colleagues rather than subordinates of the general manager, this plan cannot be adopted, nor is it usually necessary. The letters will be written in the departmental offices, but they should be transmitted to the central one to be copied and despatched. If good copying ink is used, two copies may be taken of each letter—one in the letter book, the other to be sent to the department affected, there to be pasted in a skeleton letter guard book. Where the railway system of keeping all letters affecting one subject fastened together, and retaining them on hand until the matter is finished with, the duplicate copies may be attached to them, and the correspondence will then be complete both in received letters and replies.

It is undoubtedly desirable that the general manager should, so far as possible, sign all letters except those emanating from the secretary's department; but the establishments we have last referred to may constitute an exception. The matter is one for the consideration and determination of the directors, and explicit instructions should be issued in reference to it. It should, however, be remembered that an agent binds his principal to the extent of his implied authority, and that if "a general agent exceeds his authority, or violates the orders given him, his principal is bound, provided his acts are within the usual dealing and scope of the business. And a principal cannot, unknown to parties dealing with his general agent, restrict the agent's authority to perform all things customary in the firm." (Smith's "Manual of Common Law," par. 1,121.) It is, therefore, important that care should be exercised in delegating the signature of the firm, even in the larger joint-stock companies.

Telegrams Forwarded.—All telegrams sent away should be confirmed by the following post. The triplicate telegram books, which can be obtained from any commercial stationer, are useful for this purpose, or a memorandum form may be used, stating that the following telegrams have been exchanged during the day, and are now confirmed. In the latter case the forms should be printed, and divided by a line down the centre, the left-hand portion being used for telegrams received, and the right-hand for those forwarded. It must be signed by the manager or secretary, and copied in the letter book.

The Typewriter.—The typewriting machine has become almost indispensable where much correspondence or copying has to be done. It has a double advantage: it is more expeditious than the pen, and also turns out cleaner and neater work. We believe Mr. Yarrow, of torpedo boat fame, was one of the first, if not the first, introducer of the writing machine to this country; it is now the exception for any large mercantile office to be without one. In the hands of a clever manipulator it may be used for all classes of work; letters, invoices, bills of lading, accounts current, tenders, specifications, and statistical tables may all be executed on it, and several duplicate copies may be obtained at the time of writing by means of carbonised paper. This is an advantage which will be appreciated by engineering firms having work in progress abroad, which frequently

necessitates two or three copies of letters being despatched to the firm's agent or the purchaser.

It is, however, hopeless to expect good work out of the complicated abortions which have at various times been placed upon the market as cheap machines. A good typewriter is an expensive article, but it will repay the outlay if carefully looked after and kept clean. There are several before the public which might be recommended. Each has its own peculiar points of vantage, and the makers or their representatives are always prepared to expound them.

Lady Clerks.—Ladies undoubtedly make good, if not indeed the best, typists. Where the office is sufficiently large to employ a clerk or clerks merely to type letters from dictation, and other documents from copies, the employment of ladies for the work is advantageous; they are steady and contented workers, and facile with their fingers. Whenever it is possible, however, a separate room should be provided for them, for very obvious reasons. There are some drawbacks to their employment owing to the limited range of work on which they can be engaged. A large engineering firm in North Britain, some years ago, employed a number of girls as tracers in their drawing office, and were so pleased with the result that they endeavoured to further educate them to independent labours on such work as stability calculations by Åmsler's integrator, and others of like nature, but the effort was a failure. The calculations were so inaccurate as to be worthless, and they were reluctantly compelled to confine their ladies to mechanical duties, in which they acquitted themselves admirably. Certainly some of the best and neatest work we have seen done, either in tracings or copies of machine and ships' drawings, or in typewriting, has been done by women, and it has frequently been performed at a speed which no ordinary man could excel. It is often said that they generally appear to possess no ambition; plenty of vanity, perhaps, which impels them to a certain nicety and finish in their productions, but not the ambition which induces continuous work and steady drudgery as a preparation for after, and far off, promotion. Possibly the increased employment of women in various offices may call forth in them some, as yet, undeveloped qualities; or, possibly, as in the past, they may prove qualified only for the discharge of routine and mechanical duties; time only can determine.

Register of Addresses.—It is essential in a large office, more particularly where many of the customers are abroad, that a register of addresses should be kept. In a small office the ledger may be made to serve the purpose, but there are objections to this plan; it entails extra wear and tear on a valuable book, and is apt to cause delay, or friction between the correspondent and bookkeeper. Where a separate register is kept it should be in an alphabetical index book—the Schlicht system of sub-divisions is excellent—and the book must contain telegraphic and cable, as well as postal, addresses, and kept entered up to date. The Circe card system will, however, be generally found more convenient than any book.

Printed Memorandums.—The railway companies employ a great variety of partly printed memorandum forms, having blanks to be filled in with particulars of the exact matter in question or information required. Similar forms may be used in engineering works, but they should be employed with great caution. In the first place, they may be so multiplied as actually to waste the time of the clerk in seeking the proper form to use; in the second place, they are not generally popular with the public. The irritation caused by the printed acknowledgments sent out by post-office officials is only too well known, and the feeling is not a desirable one for a trading firm to raise. When printed forms are permitted in the office they must be judiciously used, and with proper respect for any known prejudices.

Postal and Telegram Register.—It is necessary to keep a register of all letters and telegrams sent away, on which postage is paid, for cash purposes, but it is certainly not necessary to enter in it all letters delivered by messenger. It is quite true that solicitors and public accountants do so, in order to secure evidence of delivery, but trading firms do not often require such evidence, nor need to waste time and stationery in invariably securing it. The book may be a very simple one. On the left-hand side there must be a column for cash received from the cashier—the date of posting, and name and address must follow; and on the right-hand side a column for the amount of postage. After this, however, there must be a column for remarks, for the purpose of noting any postages to be charged to customers or others. These will usually be inserted by the accountant in his

periodical examination of the book, as the office boy or junior clerk who keeps it will not have sufficient knowledge of the terms of contracts or sales to do so correctly.

This book should be balanced once a week, and the balance produced to the cashier in stamps or cash. It should be treated merely as a memorandum account, and the cash advanced by the cashier posted direct to the debit of postages and telegrams in the commercial books of the firm.

The postages and telegrams chargeable to customers and others can be credited to postages, &c., if deemed desirable, by an analysis of the sales book, but the amounts will usually be so trifling that it is hardly worth the trouble.

Filing Letters.—Whether a received letter register be kept or not, it is evident that some system must obtain of filing letters so that they can be readily found. When there is an excessive number to deal with, and numerous references have to be made to them for years afterwards, or where accuracy of record is essential, as in some government offices, it is more convenient to mark each letter with a register number, and file it according to that number. This method may, however, have numerous modifications, but if the register number is adopted, Lapper's system in its entirety (with use of file numbers) will probably prove the most convenient. It must be observed that the progressive file number is only inserted as the letters are put away, and there is, therefore, no unpacking of old bundles, except for the occasional return of papers taken out for reference.

But in a general engineer's office, as in most mercantile offices, it will usually be found more convenient to file letters by date in alphabetical divisions, thus saving the trouble of searching the register each time one of them is required. Pigeon holes and box files of various kinds may be used for this purpose, but there are three files which are pre-eminently adapted for it—the Shannon, the Amberg, and the Ceres. The Shannon and Amberg are of American make, and well known for their excellent workmanship, but there are now some good English makes on the market constructed on the same principles. In the former the letters have two holes punched in them by a small punching machine, and by these they are held in place in the file; the Amberg, on the other hand, does not mutilate the papers in any way. Both have their admirers,

and each possesses advantages peculiarly its own. The Ceres is a more recently introduced file, of English manufacture, and the invention of Mr. T. Bowater Vernon. Like the Amberg it does not mutilate the papers, and it possesses such advantages over its American competitor in elasticity in use that it will probably become the more popular when generally known. The capacity of these files is so real and considerable that they are much less expensive than appears at first sight; their general convenience, and the number of papers they will hold, should be considered as well as the price.

The railway companies now almost invariably adopt the method of keeping *all* the letters on one subject pinned or otherwise fastened together, and many engineers find it convenient to do so. It no doubt saves trouble in searching through a number of dates, but is liable to cause difficulty unless it is associated with a register number, or care is taken to file the correspondence under the initial letter of the principal writer. It is usual with the railway system to keep the letters on hand in baskets or drawers in the correspondent's desk until the matter is completed, and then file them. Subject to this modification, all letters should be placed on the file the date they are answered. It is impossible to maintain order, or get the work promptly dealt with in this department, if letters and papers are allowed to accumulate in bundles waiting to be put away. It is hardly necessary to say that all original letters and documents must be returned to the general office to be filed; when it is necessary to do so the departmental and subordinate officers must take, or be furnished with, copies for future reference.

Quotations by Standard Prices.—Now all this work in the correspondence office is merely subsidiary to other work of greater importance to the profits of the firm: first, to the purchase and delivery of materials; and, secondly, to the effecting of sales. The first portion has already been considered, and the second portion now claims equal attention.

When any application is received for a quotation for a machine of standard pattern, included in the published catalogue of the firm, there can be little difficulty in dealing with it. These catalogues are sometimes published with prices inserted, and the correspondent can then either send a copy or give the quotation. When the catalogues are

published with blank prices there should be kept in the office a completed copy, accessible to the correspondent and other authorised clerks, and the reply will then be equally easy. It, however, frequently happens that manufacturing engineers employ accredited agents in various districts, and an application may come from one of these agents for a price for a particular machine, with a request for increased commission or increased discount, in whichever form the allowance may be made. This really amounts to a reduction in price—a local or temporary reduction possibly, but still a reduction. A question at once comes up which must be dealt with by the manager of the firm, and dealt with on the same principles which rule prices generally.

Foreign correspondence in reference to orders from standard lists will involve this factor of variation more frequently than do home enquiries. It is all very well to send price lists to Chili, China, or Peru, and say “these are our prices;” the purchasers there are entirely of the way of thinking of the Austrian school of economists, that the consumer fixes the value, and they endeavour to do this by setting off one maker against another, and taking the offer of the cheapest. Most frequently the order, or proffered order, will come through the firm’s agents abroad, accompanied by an intimation that an extra discount must be allowed to the purchaser, or an extra commission given the agents, out of which they can satisfy his appetite for back-sheesh. With some descriptions of trade, and with some countries, these demands for reductions from list prices are so frequent as to practically render the lists useless, and the trade a mere “higgling of the market” for every machine, from a compound vertical engine to a noria or a chaff-cutter. Sometimes the decision has to be made on the very spur of the moment, and the answer given by telegram. It is therefore expedient for the manager to keep in his own possession a catalogue marked with the ordinary quoted list prices, and also with the lowest prices which the firm can afford, under pressure of competition, to accept.

These lowest prices must be based on the actual cost of construction, ascertained from time to time by the detailed accounts kept for that purpose by the firm.

CHAPTER X.

THE PREPARATION OF ESTIMATES.

Nomenclature of Machine Details.—We are thus reverting to the important subject of estimates and tenders, but before proceeding therewith it is desirable to consider the names given to machine details. No system of naming them appears to have received general assent in either this country or America, and the catalogues of one maker are, partly in consequence of this lack of system, difficult of comparison with those of another. Whether any universal nomenclature can be secured is problematical, but at all events, one very honest, and apparently successful attempt, has been made in America to provide a reasonable scheme.

The system to which we refer has been in use for a long time past at the Ferracute Machine Works, Bridgeton, N.J., and was some years ago described by Mr. Oberlin Smith, the President of the works, in a lucid paper read before the American Society of Mechanical Engineers. A reprint of the paper will be found in Messrs. Garcke and Fell's work on factory accounts (published by Crosby Lockwood and Co.), at page 152 of the 1887 edition. He describes very clearly the difficulties attending the ordinary unsystematic nomenclature, and the use of synonyms and of technical words in more than one sense. Even when an effort is made for orderly and scientific method, the result hardly seems satisfactory to him, although probably the absurdities were then more pronounced on the other side of the Atlantic than they now are on this. "A perusal of some machinery catalogues," he says, "which give detailed lists of parts, is very harassing to a systematic mind. They are apt to derive one part name from another, prefixing the latter as an adjective each time, until some such pleasant title as 'lower-left-hand-cutting-blade-set-screw-lock-nut' is evolved. If there are symbols provided, they consist of

some unknown combination of letters part way down the list, and then change to arbitrary numbers, or perhaps to nothing at all. It will often be noticed that no particular order appears to be followed in numerical arrangement, similar parts being scattered at random through the list."

The Ferracute Company tried various methods: small letters, capital letters, and figures, and combinations of the three. They even ventured on the Greek alphabet, but had to abandon it, as it excited suspicions among their more ignorant workmen of something diabolical being interceded. Finally they adopted what they term their symbol system, which is as follows:

Machine names and piece names are carefully selected by the designer of the machine; piece being a part reduced to the last condition of sub-division, or so welded or glued together as not to be again taken apart. It is evident that the success of the system will very greatly depend on the ability displayed by the designer in thus naming them; no two machine names must be alike, the machines being different, and not merely of varied sizes, and no two piece names must be alike in the same machine. A *machine symbol* consists of a group of *three arbitrary capital letters*. A *piece symbol* consists of an arbitrary *number*, and follows the machine symbol, connected therewith by a hyphen. Thus the symbol for the handle of a force pump of the smallest size would be F. P. A.—2; whilst the symbol for the pump itself would be F. P. A. The last letter in the combination represents the size of the machine (there will seldom, if ever, be more than 26 sizes of any one machine made in any shop); the first two letters should, for the sake of suggestiveness, be initial, as in this instance, and where the initial connection can be maintained by changing the title of a machine, it is perhaps advisable to make the change. Thus F. P. A. would stand either for force pump A, or foot press A, but Mr. Oberlin Smith alters the name of the latter machine to treadle press, an equally appropriate and suggestive title, and which permits the use of the symbol T. P. A.

The elasticity of the system will be seen from the fact that the permeations of three letters throughout the alphabet will permit of 17,000 symbols, and its comparative brevity is shown from the following Table A taken from his paper:

TABLE A.

1st.	2nd.	3rd.	4th.	5th.	6th.
Full Name of Machine and Piece.	Our Symbol for it.	Symbolic name as often used.	Characters in col. 2.	Characters in col. 3.	Excess of col. 5 over 4.
6" x 4' Engine Lathe, spindle head..... }	E.L.A. - 4	Engine Lathe, A - 4	4	13	9
No. 4 Power Press, frame }	P.P.D. - 1	Power Press, D - 1	4	12	8
7" x 14" Steam Engine, crankshaft }	S.E.G - 51	Steam Engine, G - 51	5	14	9
Buckeye Mowing Machine, left axle nut }	M.M.D. - 81	{ Mowing M'chine. } D - 81	5	16	11
No. 3 Glass Clock, main spring }	G.C.C. - 105	{ Glass Mantel } Clock, C - 105	6	20	14
One-hole Mouse Trap, choker wire }	M.T.A. - 3	{ Wooden Mouse } Trap, A - 3	4	17	13

Table B, which hereafter follows, is taken from the same paper, and is a specimen of a part of a page of the Ferracute Machine Company's "symbol book." It almost explains itself. The machine symbol letters stand at the top of the page, and therefore are not repeated in the first column. "Same as" refers to a part of some other machine, with which the part in question is identical. The quantity column tells the number of pieces of a kind required. The last weight column, added upwards, shows the total weight of the machine, a very useful adjunct to catalogue information. The piece numbers are *gapped* after each kind of material, and also at the ends of groups, so as to allow of future changes and additions, and also to ensure the same piece numbers being used for identical portions of other machines, which are similar in general design and construction, but which have a few more parts in them.

The order in which the pieces are numerically arranged cannot be determined in all cases by positive rules, but the instructions of the company appear to be very elaborate, and are probably modified from time to time as necessity arises. Generally speaking there is a double classification, as in Table B. First, by materials, a gap being allowed in the numbers (and also, we presume, in lines) after each

TABLE B.

F.P.L.		No. 3 Foot Press.			Weight.		
Piece No.	Same as.	Piece name.	Material.	Quantity.	Rough weight.	Finished weight.	Aggregate finished weight.
1	.....	Frame	Cast iron	1	220	200	200
2	.....	Gib	„	1	10	9	9
3	.....	Side bar	„	1	45	40	40
4	.....	Front leg	„	2	30	30	60
5	.....	Back leg	„	1	40	40	40
6	.....	Treadle	„	1	17	15	15
7	.....	Lever	„	1	85	80	80
8	F.P.H. - 8	Lever weight.	„	4	5	5	20
9	.....	Pitman	„	1	12	10	10
10	F.P.H. - 10	Clamp sleeve.	„	2	3	2½	4½
21	.....	Lever pin	Steel	1	2½	2	2
26	F.P.J. - 26	Treadle and Pitman bolt	Iron	3	¾	½	1½

material is exhausted. Secondly, by grouping, the pieces of the same general order being placed together, and in natural machine-shop order—first planing, then drilling or boring, then turning, the heaviest and most important pieces coming first. Between each group a gap is left, in the same manner as between each class of material.

For indicating alterations of parts of a machine a supplementary symbol is adopted. A small letter after a piece symbol (as F.P.L. - 21 - *a*) signifies that the piece is obsolete, the standard F.P.L. - 21 having been altered. Mr. Smith admits that this is not quite correct, or, as he terms it, “strictly logical, as it gives the same symbol to a piece in present use which, in a previous year, was given to a somewhat different one now obsolete.” This defect may, however, have now been corrected. It could easily be done by adding the small letter (*a* for a first alteration, *b* for a second, and so on) to the *altered* piece, and making

reference thereto in the symbol book opposite to the original number. Of course, a remarks column would have to be added for this purpose, but such a column is useful in any case.

A further supplementary symbol is used, for purposes of internal accounts only, by the Ferracute Machine Company, which may best be described in Mr. Oberlin Smith's own words: "It is to indicate the number of an operation in the construction of a piece, and is written thus: F.P.L-21-1st F.P.L-21-2nd, &c. Its use is of great value on detail drawings, time cards, and cost records. It enables any operation (no matter how trivial) or any piece of any machine to be identified by a symbol alone. An *operation* we define as any work which is done by *one person* at *one* time, before passing the piece along and commencing upon another."

The symbol system of the Ferracute Company has undoubtedly many advantages, not merely in saving of clerical labour (which is an economy always to be aimed at), but also in the greater facilities it affords for references. In order, however, to obtain the full advantage which it presents, it should not only be adopted in the drawing office and works for technical records, but should also be used throughout the commercial department and in the catalogues of the firm. But here arises a difficulty. Commercial clerks are very seldom qualified to describe a machine or its varied details in an intelligent manner; indeed, the average commercial clerk has proved himself so unfitted for anything beyond routine duties that a large proportion of his own proper work has perforce passed into the hands of outside experts. To permit the nomenclature to be fixed in the commercial department would, therefore, be to render confusion worse confounded. It is evident that there is no other satisfactory method of compiling Table B than entrusting it to technical officers, and since none of the officers about the works possess such facilities for constant access to drawings and other records as the draughtsman does, it would appear that the drawing office is the proper place for the compilation of the table.

The names and symbols when fixed should be recorded in a permanent book, and written copies thereof sent to the various officers and departments of the works. These copies should be fastened, for future reference, in skeleton guard books, and carefully and fully indexed. The original record book in the drawing office will be subject to con-

siderable wear and tear, and should therefore be of thick hand-made paper, and strongly bound; indeed, it would be better also to have the copies sent to the works written or typed on hand-made paper, of good quality.

Estimate Clerk. — The estimate clerk should be thoroughly reliable and experienced. His work is so intimately connected with costs that it may possibly be desirable to have both estimates and costs supervised by the same officer. No clerk of the commercial department should, however, be permitted to complete any estimate according to his own knowledge or anticipations. He must be merely an intelligent compiler and recorder of facts furnished to him by the technical officers, and must finally submit his work to them, or one of them. Proper forms of estimates will, however, assist him to arrive at an orderly compilation.

Catalogue Estimates.—For every machine or other item in a trade catalogue or list a proper estimate should, in the first instance, be prepared in the same manner as for an individual tender. It should also be prepared in such form that a corrected future estimate may be readily placed in comparison with it, not merely in total amount, but in those numerous details through which that amount is arrived at. This may be done by keeping the list estimates in one or more bound volumes, and having the books so ruled that both the first and also the subsequent figures may appear on the same page. The following ruling will answer the purpose, the number of estimates allowed for being limited only by the width of the pages, but not being less than three—more were better:—

[illegible]

The page should be headed with a complete description of the machine, the catalogue wording being usually the most suitable for adoption. It should also contain a full list of all the details to be supplied with the machine.

The column marked "names of parts" should be divided into as many as conveniently possible. And here will be seen the advantage of using Mr. Oberlin Smith's nomenclature. The representative symbols used for any part will then have a distinctive meaning, not merely in relation to its own particular machine, but also in relation to any other machine for which a similar part, even of different dimensions, may be required.

It will be observed that this calculation gives the estimated cost, of material, and also the estimated wages given under the heads of the various trades, which may be increased to any number the manager requires separately shown as employed on the work. At the foot a summary must be made in manner following :—

Total wages	£.....
Add cost of materials .....	.....
<i>Total estimated nett cost</i> .....	.....
<i>Add—</i>	
Use of machinery and tools at a fixed } proportion of.....%	}
Management expenses, including } superintendence, rent, insurance, gas, water, &c., at a fixed proportion of.....%	
<i>Total estimated gross cost</i>.....	.....
Add for profit .....	.....
Catalogue price	£.....

Now this, as indeed all estimates are, is but an anticipation, a forecast, of expected results, and cannot be supposed to strictly agree with the financial books of the firm, as cost accounts must do. But, exactly in the same way as in detailed cost accounts, and in the accountant's ordinary ledger, no profit should be permitted to be made on the stores issued, or on the wages paid; so in all estimates, the actual cost of stores to be consumed, and of

labour to be employed, should be placed against each item as nearly as they can be anticipated. This is necessary for comparison with the completed results, and desirable to enable the manager to judge of the actual amount of profit he can make on the machine.

Averaging Cost of Materials.—In fixing the prices of materials for catalogue estimates, it must be remembered that the calculation is made for a considerable time ahead, and not only for the immediate future. Care must therefore be taken to average the prices, especially of such valuable and widely fluctuating materials as copper, tin, and their compounds, and to compute this average over a sufficiently long period of time to make it reasonably safe for practical purposes.

Weight of Materials.—The approximate weight of materials required must, in the first instance, be furnished by the draughtsman from his calculations. These drawing office calculations have now been elaborated to such nicety as to give little difference between the calculated and the actual weights. When, however, any new machine, or new size of standard machine, is made, each part of it should be carefully weighed or measured, and the results recorded in the column of the estimate for "Actual weight or quantity used." This column, and not the estimated column, must be taken as the data for any subsequent estimates.

Establishment Charges.—It will be observed that the establishment charges for use of machinery and tools, and for management charges, are added "at a fixed proportion of.....%" As we shall see later, in ordinary estimates this percentage is based on the proportion the present establishment charges bear to the wages on contracts running, and on tenders rendered, which it is expected will be accepted. But when we remember that catalogue estimates are to extend over a considerable period; that the revision of them may probably be undertaken at irregular intervals; that during these intervals times of trade depression and trade advancement may alternate; and that questions of extra commissions, or special allowances will frequently arise, and be decided before they are revised, it will appear that a commercial question of some complexity arises. The cost accounts will exhibit these variations, but in the present instance it is not variation we require, but a stable figure.

During the time when the works are only partly employed, and there is no immediate prospect of new contracts, such charges as interest on machinery, depreciation, current repairs, management salaries, rent, insurances, and taxes, will bear a greater proportion to the wages for direct labour than they would if the yard were full of engines and machines in progress. This increased dead-weight charge cannot, however, be obtained from the customers: it must come out of the profits of the firm, and must be so dealt with in the estimate. Many engineers, therefore, assume the works to be in full progress, and on the labour wages thus estimated they calculate the percentage of establishment charges. This certainly gives the best figure on which to arrive at the amount of profit which will be obtained, but it has the disadvantage of giving establishment charges which may not approximately agree with the completed costs. A reconciliation may, however, be effected by preparing the summary already given in dual form. In the first the use of machinery and management expenses must be taken at the proportion they bear to the wages under the present and immediately anticipated conditions of the establishment. This will be the basis for comparison with the cost accounts. In the second the same charges must be added at a fixed proportion, which they would bear to the labour wages under full conditions of work in the factory, and the figure thus arrived at will be the minimum which can be accepted for the machine, &c., without incurring actual loss. This figure may be entered on the manager's private catalogue as his minimum price.

Profits on Standard Machines.—There is a line "Add for profit" on the foregoing summary. We are dealing now with catalogue prices, and with standard patterns of machines, which are frequently made for and sold from stock. With goods of this class the engineer has little opportunity of fixing the profit himself: he is bound by the prices which his competitors in trade are charging, which they advertise in their lists, and which are well known to his customers. He must fix his catalogue prices by those ruling in the market, and he must arrive at his estimated profit by taking the difference between those figures and the estimated gross cost.

Estimates in General.—When we come to consider those estimates on which tenders of a more general and

competitive character are rendered we shall find greater difficulties confronting us. The variations in purely commercial conditions are greater; many of the factors which determine the conclusion of the contract are unknown; and consideration has to be given to items which in standard machines may be neglected in order to secure the advantage of a constant, or apparently constant, price to place before the customers.

And, first, it must be remembered that the superior equipment of a firm will give it no advantage over another in market price for equal work. No doubt the good reputation of a firm will frequently determine the allotment of a contract in its favour; indeed, reputation sometimes gives a firm, or group of firms, the practical monopoly of a particular market for a time, but this determination or monopoly will not result in more than a temporary advantage in price, for it will pass away immediately it is apparent that equally good work can be produced by other firms at lower prices. Nor is "good reputation" synonymous with superior equipment. It may probably include it, but it also includes, and in reality is more dependent on, superiority of management, skilful training of workpeople, and faithful observance of obligations, than on perfection of workshop tools. These are an advantage to the possessors of them, but rather by reducing the cost of production, and thus securing a larger margin of profit, than by obtaining a price higher than the ordinary and usual market quotation.

If, therefore, superior equipment affords little or no opportunity of gaining payment higher than current rates for *equal* work, it is evident that the estimator must make himself acquainted with those current rates, and note their variations. It is, however, needful that he should bear in mind the significance of the term "equal work." If, either by superiority of supervision, by superiority of workman skill, or through the more complete furnishing of his factory, he can turn out a better engine or machine than his competitors, he will be entitled to ask, and in general will secure, a higher price than they can obtain. He is offering his customer something more than others do, and he is entitled to be paid for this increased value. The possibility of higher price is, however, limited by the customer's demand; by the consideration whether he desires a better article, or whether the inferior one will serve his purpose equally well.

Data for Estimates.—There are three methods on which the preparation of estimates may be based, namely :—

1. On approximations to the supposed tenders to be made by competing firms.
2. On calculations of anticipated cost of materials and labour, with such profit added as it is thought the work should reasonably yield.
3. On an examination of the cost of former work of a similar character, adjusted by allowances for differences in dimensions, in rates of wages, and in market price of materials, with reasonable profit added to such corrected cost.

The first way is mere guesswork—though even in guessing some men are more expert than others—and may therefore be dismissed as eminently unsatisfactory. In some foreign tenders, particularly when they are for foreign governments or municipalities, the guessing is supplemented by information obtained by bribery from the government agents or the competitors' employees. We do not imagine our readers will be guilty of such dishonest practices, but it is well to warn them that firms do exist who are so unscrupulous as to resort to them, and it is therefore necessary to scrupulously guard the figures of estimates and tenders from being prematurely disclosed.

The third method is really more useful as a means of checking independent calculations than as sole datum for a tender. In subsequent paragraphs the essential features and results of detailed cost accounts will be dealt with, and an examination of them will disclose the extent to which they may be used without any further verification. It may, however, be said that as a means of corroboration; as a comparison of actual results with previously-anticipated costs; as a warning against additional expenses and leakages which are often overlooked, they are of the utmost service. For this subsidiary purpose they will be cherished and referred to, both by the experienced estimator and by the general manager to whom his completed work is submitted for approval.

The second method of estimating therefore remains as most deserving of consideration, and as it involves one very potent factor in the profit or loss of the firm, it demands considerable study on the part of the young engineer. The prices of engines or machines may from

time to time alter, and the charges for repairs or renewals may vary in different places, but the same general principles should guide the estimator in fixing them. Details, so far as they are affected by either time or district, may be acquired by him from various sources, the local conditions especially demanding consideration. There is some excellent information given in "Engineering Estimates, Costs and Accounts, by a General Manager," published by Crosby, Lockwood, and Co., but in using this, or any other work quoting actual prices, due allowance must be made for changes in the markets for materials, for rise or fall in wages, and for the gradual evolution of labour-saving devices, as well as for the situation of the factory or works.

Order of Estimate.—The advantages which result from following in the estimates the same divisions into parts or sections which will be, or are usually, adopted in the cost accounts, will be apparent when the facility of comparison thereby afforded between anticipated and actual expenditure is considered. There is a close connection between the two, and when there is any material increase in actual cost over preconceived cost, the reason for it should be minutely investigated by, or under the directions of, the manager.

Now there is a certain natural sequence in which it will be found convenient to place these particulars, the order being, to a large extent, that in which the work is performed. It will be seen most vividly in one of the larger, and more complex structures, but it is equally to be found in the smallest machines. If, for instance, the tender is asked for a large cargo steamer, it is evident to the merest tyro that the preparation of some of the drawings, of the working model, and the laying off in the mould loft, are the earliest portions of the work which will be done under the contract when secured. After these follow laying blocks; then the keel, stem, and sternpost; then the frames, and afterwards the plating and riveting of the frame and bulkheads. The most reasonable and natural order to follow in the estimate, is to commence with these items, to follow with other work which will progress in the shops ready for fitting in place when the ship is prepared to receive it, or which will be proceeded with immediately the framing, and plating are sufficiently advanced; and then to finish with such later work as

decks, hatches, deck and other fittings, cabins, boats, masts and rigging, &c., &c. The sequence in the Form B of the system of cost accounts, hereafter suggested, will closely follow the same order, and thus render it easy to make detailed comparisons.

Labour and Materials.—The cost of any work consists of two items: materials used for it, and the salaries and wages paid for preparing and finishing such materials for their ultimate purpose. Here there is a distinct line of cleavage, of which advantage should be taken to effect an additional sub-division of the estimate. To ensure this the form should be ruled with double cash columns, in the following manner:—

Particulars.	Weight or quantity.	Price.	Materials.			Salaries and Wages.		

Quantities of Materials.—It has already been stated, in reference to catalogue or list estimates, that the weight or quantity of materials must be supplied by the draughtsman. This is more especially the case with the estimates now under consideration, in which the weights will vary not only in relation to the total size of the construction, but also in relation to its design.

There is really no excuse for errors in quantities, not even when they are so sub-divided as to render actual measurement from drawings difficult or impossible. When these smaller weights are estimated (and they may frequently be estimated very closely, if not exactly, from former machines of the class) they must be checked by references to the total weight. If the aggregate of the machine does not approximate very closely indeed to an aggregate arrived at from the drawings or former records, then the draughtsman must make a search for the discrepancy, and continue to search until he finds it. "Near" or "near enough" is not scientific, and must not be permitted in the scientific office of the firm.

Approximations from Former Constructions.—Where the data of a former contract are used as the foundation for an estimate, whether in figures of cash or quantities, and

additions made thereto for increased size, there is great necessity for extreme care being exercised. Errors have at various times arisen through increased length being added, without any allowance for increased circumference. In one case, we remember a mistake involving the loss of over £5,000 to the shipbuilders, in consequence of the estimator allowing for an increased length of a ship without considering that she was also to possess greater beam and depth. The error is more easily made, particularly in some classes of work, than the reader will readily imagine, and more especially when a tender has to be hastily rendered, or the directors or manager are pressing for figures on which to base it. One precaution may be taken in all cases, and should never be neglected in these approximations, and that is a revision of them by the chief draughtsman. The simpler calculations, and sometimes all of them, are usually prepared by one of the ordinary draughtsmen, of course by one with a sufficient amount of knowledge and experience, and it is therefore only an exercise of ordinary care to have them all submitted to the head of the office, before they are passed to the commercial department for any action involving financial results.

Boiler Specification.—The pitfalls which surround the subject will be seen by a cursory consideration of a Lancashire boiler. It is one of the simpler forms of construction from a commercial point of view, and does not present the difficulties which are met with in gas, oil, or steam engines, in electrical machinery, in steamships, or in that mass of complexities which go to make up a modern railway. Simple, however, as it is, we find in a specification prepared by one of the boiler insurance companies such materials as the following :—

- Boiler Shell,
- Flue Tubes,
- Ends and Stays,
- Angle Iron,
- Steam Receiver,
- Manholes,
- Safety Valves,
- Feed Valve and Pipe,
- Blow-off Pipe and Tap,
- Fusible Plugs,
- Grate Bars and Doors, or Mechanical Stokers,
- Footplates, Dampers, &c., &c., &c.

Now, it is well known to engineers that the labour expended on these materials will vary considerably, that some of them will demand workmanship of different character, and of greater extent than other portions, and that, indeed, some, such as fusible plugs, will be purchased in a finished state from other manufacturers who devote their attention to those particular articles. If, therefore, the draughtsman gave the total weight of the boiler only instead of dividing it into parts, it is evident that the estimator would be at considerable disadvantage in fixing the amount for labour, and liable either to overlook some of the highly-paid but more obscure portions of it, or in an excess of zeal to charge the whole at too high a rate. Nor, apart from the labour, would it be convenient to group the material into one or two lots, since it is of varying character, and consequently of varying prices. If it be desirable, in a simple form of construction like Lancashire boilers, to divide the estimate into different classes of materials and labour, in order to arrive at a near approximation to anticipated cost of completion, it must be far more important to do so in structures which have a far greater number of parts, and greater differences in the construction, finish, and materials of those several parts.

CHAPTER XI.

PREPARATION OF ESTIMATES (*continued*). TENDERS SENT OUT. ORDERS RECEIVED AND RECAPITULATION.

Price of Materials.—It is equally necessary that the price at which materials are charged in the estimate should be a correct one as that the proper quantities should be given. We have already said that no profit should be made on either materials or labour in the body of the estimate, but that both must be entered at the actual cost to the firm; but this does not quite represent the whole of the case. The firm may have in stock stores left over from former contracts which will be used on the intended work, but the market prices of which have fallen since they were purchased. As there will probably be one or more competitors who are not hampered with such stocks, and who are therefore free to buy in the open market at the lowest prices at present available, it will be useless estimating for more than these prices. Any difference between the two will form a reduction of the firm's profit; a loss of some of the money they would make out of the work if they were more happily situated. On the other hand, it may occasionally happen that stock will be held which has been purchased at less than current prices, and in this case a like course must be followed, and the present values be inserted in the estimate form. A remark should, however, be made in the margin, where the quantity and amount is material, showing that a difference exists between the actual purchase and present market price and the amount thereof, so that the manager or directors may give to it such consideration and effect as they deem necessary when fixing the sum to be added for profit.

Unstable Equilibrium.—We have, however, not yet exhausted the question of price. It must be remembered that every market is usually in a state of unstable equilibrium, and that its quotations vary from day to

day. Sometimes these fluctuations do not very greatly depart far from a common centre: the tendency one day will be to a little harder quotation, and the next to a slightly easier one, but the average will continue about the same from week to week. At another time the beats will be stronger in one direction than the other, and although part of a day's loss or gain in price may have to be abandoned later in the day, some of it will always be retained, and the morrow will witness a repetition of the process. We have thus the condition of an ordinary rising or falling market, a condition which will continue until such time as demand and supply shall equal each other at the price then attained, and under the circumstances and anticipations then subsisting. When this stage has been arrived at the market will once more revert to its normal state of unstable equilibrium. The causes for a rising or falling market are many and varied, and comprise currency conditions, political disturbances, and fluctuations of discount and exchange, as well as the quantity of available material, or the immediate demand there may be for it. The prescience which enables some men to discern and take advantage of these market changes is most valuable, and should be sedulously cultivated. It is more a commercial instinct than the result of workshop training, but it is an instinct which no true business man will fail to cherish and develop.

There are, it is true, at times sudden, unexpected, and momentous changes in prices which are almost in the nature of panics, and are frequently closely connected with financial crises. The effect is generally disastrous, and causes great dislocation of business, but they are too irregular and uncertain, both in inception and duration, for any effect to be given to them in ordinary estimates.

We may, therefore, amend our rule, and state it in these terms: No profit must be taken in the body of the estimate on either materials or wages; *both must be calculated at current market prices, modified, however, in a rising or falling market by allowance for the anticipated extent of such variation during the continuance of the contract.*

Estimation of Labour.—The second money column of the estimate is more difficult to deal with than the first. If the market for materials is occasionally subject to panic fluctuations, the force and duration of which cannot be foretold, the cost of labour is in a constant state of unrest,

arising not only through demands for increased wages, but also through the modern pretensions of trade unions to a limited partnership, and therefore to the control of the labour employed. This restless condition of the labour market, and the difficulties which arise therefrom in anticipating the productive value of the men's time, make this portion of the estimate more difficult of correct adjustment than formerly; and most managers of experience will admit that it always presented sufficient perplexities. Workmen in different localities, or trained under varying conditions, both of workshop practice and equipment, and home and social influences, will render, one from another, a distinct tale of work. Whilst, therefore, most foremen and managers can determine from their own experience the time and number of men which will be occupied on any piece, in like circumstances to those to which they have been accustomed, these circumstances are now constantly changing, under stress of development of machinery, of perfection of appliances, and of the workmen's aspirations and demands, and this changeableness must be carefully remembered when the future value of it is under review.

Estimated by Technical Experts.—It seems scarcely necessary to say that the labour must be estimated by technical experts—that is, by foremen and sub-managers—just as the quantities are furnished by the draughtsmen. And yet the caution is not wholly unnecessary when we think of the trend of modern business. Year by year private firms of even small dimensions are transformed into joint-stock companies, and in many of these companies the banking, money lending, and dividend-seeking element is predominant. The directors during their tenure of office are compelled to turn their attention to immediate profit, rather than to those improvements in design, or management, or equipment, which yield only deferred gain. The approval of the auditor is most essential to such a board, since he is primarily the representative of the bankers and investors, and the auditor relies on the clerks, with whom he is brought into immediate contact, rather than on the expressions or advice of foremen, whom he will generally understand very imperfectly. There is grave danger that a tendency may be created to rely too greatly on the knowledge of the clerky class, and to credit the members of it with the ability to use the tables and statistics they so neatly and carefully compile. The difficulties already

pointed out in the computation of the cost of labour ought to convince either directors or manager that no ordinary clerk is capable of dealing with this part of the estimate, and that it should be left to the officers who have the direct oversight and management of the workmen.

Cost Accounts.—One of the clerks can, however, render great assistance to the technical officers, and that not merely in a subordinate capacity, but in actual consultation with them: we refer to the cost accountant. He has, or should have, in considerable detail, particulars of the expenditure on former machines, or works of like or analogous character, and if he is properly versed in his work he can point out variations therein, and the extent to which they have arisen from changes in rates of wages, or in working overtime. These costs and explanations, if judiciously used, will be of material assistance in filling up the second money column. Whenever it is possible they should be consulted before any tender is sent out, since they very graphically point out the capabilities of the firm gathered from its actual efforts on previous occasions.

Foremen's Records.—But cost accounts are not always available. By most firms they are jealously guarded, and very properly so, from inspection by any but a few trusted and trustworthy officials, and sub-managers and foremen are not always included in this category. As, however, they may at any moment be called upon to complete the labour portion of an estimate, or revise one previously prepared, it is desirable that they should be permitted, and even encouraged, to keep their own records of the time occupied on any work. They have access to the pay sheets, and might conveniently and advantageously be permitted access to the analysis of them, and can therefore readily prepare their own records from the firm's official documents.

It must be clearly understood that these records, even in the attenuated form recommended, are confidential documents, and must not be disclosed to the prejudice of the firm. There will be little danger of this breach of trust if the foremen are carefully and judiciously selected, and a spirit of thorough loyalty and truthfulness is cultivated throughout the works.

The records may be kept in any convenient book: an ordinary foolscap book, faint lined, will be found suitable for permanent record, and the pocket memorandum book

will serve for temporary note of any extracts or explanations to be afterwards transferred to it.

The following particulars should be obtained, but so long as these are available, the exact form in which they are written down is immaterial. Ruling vertical columns for the different trades may probably be found to save time and trouble.

1. The engine, machine, or other construction must be stated in sufficiently definite terms and dimensions to identify it at any future time.

2. The work must be divided into, at least, as many parts as are separately stated and dealt with in the specification. This division may, however, be carried much further in the foreman's own record book, as his object should be to ascertain the time spent on each detail of a machine, and not the total on the whole machine.

3. The record should be of time only, and not of money, so that in future references the complications arising from alterations of rates of wages, and from overtime, may be eliminated.

It must be clearly understood that accuracy must be attained through the exercise of great care, as the book-keeper's test of "balancing" can hardly be resorted to. These time records are kept for a special purpose, for the information of the foreman in charge of the work, and it will be found a waste of energy to multiply them over and over again, in cases of standard machines wherein there is no practical variation of the labour expended.

It is essential that any temporary causes which interfere with the labour on any job, either retarding or accelerating it, should be noted, so that the record of time occupied will not be misleading when such causes are removed.

Steamship Estimate.—There are other items which demand consideration and adjustment before the estimate is complete, but it will be convenient to consider these in a model form. Probably a steamship contains as many complications as will be encountered by the average engineer, and will therefore be most suitable for the purpose of example. Simpler constructions will present no difficulties if the more complicated ones be understood. Some of the following details are taken from an actual specification given by Mr. John Grantham, M.Inst.C.E., from which it will be readily observed that a considerable

number of items have been omitted, but there is no need to specify them since they do not demand special notice; the same methods will apply to them as to frames, bulkheads, plating, and cabins and fittings.

ESTIMATE FOR A STEEL PADDLE STEAMER FOR MESSRS. LLOYD, JOHNS, AND CO. TO BE BUILT UNDER LLOYD'S SPECIAL SURVEY. FIVE LONGITUDINAL BULKHEADS.

DIMENSIONS—	Weight or Quantity.	Price.	Cost of Materials.	Salaries and Wages.					Total Wages.
				Shipwrights.	Platers and Riveters.	Blacksmiths.	Fitters.	Labourers	
Length.....	450 ft.								
Beam.....	54 "								
Depth below cabin	8 "								
Height of cabin...	10 "								
Height under plat- form	10 "								
Drawings, laying off, and model.....									
Laying blocks									
Keel, stern, and stern- post									
Frames									
Stringers									
Beams.....									
Plating and riveting ..									
Rudder									
Bulkheads									
Main deck									
Lower deck									
Platform deck									
Cabins and fittings.....									
Saloon									
Engineers' berths.....									
Sidelights									
Steering apparatus.....									
Anchors, chains, &c.....									
Painting									
Outfit (detail, unless) it is the usual one).. }									
Cost of survey									
LESS, scrap metal									
ADD—Cost of materials									
TOTAL ESTIMATED NETT COST									
ADD—Use of machinery and tools									
Management charges (including superintendence, rent, rates, insurance, gas, water, &c)									
TOTAL ESTIMATED GROSS COST									
ADD FOR PROFIT									
Tender									

Wages and Salaries.—It will be observed that the salaries and wages are divided under five heads; in some cases, and for some forms of work, it may be desirable to

adopt a greater number of divisions, whilst for others it is sufficient to use only the single cash column for wages and salaries. Convenience and common sense must be the guide.

The salaries and fees of partners, directors, and managers, and the wages of draughtsmen, foremen, clerks, timekeepers, storekeepers, &c., should not be divided over the several items; they are included under the head of establishment charges. Where, however, the work is of such a nature as to require the exclusive services of one or more draughtsmen or foremen, then their wages must be entered as a special item, care being taken that the charge does not again appear under some such head as drawings, laying off, and model.

Drawings, &c.—In many instances it is necessary to prepare some of the drawings before making a tender—in a ship, for instance, a midship section is invariably got out—in others the drawings will only be commenced after the contract has been secured, and continued as may be necessary for the work to proceed. In either case the contract or order should bear the expense, and where it is possible to isolate the anticipated cost it is better to include it separately in the estimate. It will be so shown in the cost accounts, and for purposes of comparison it is desirable to follow the same course at the beginning.

Blocks, &c.—In shipbuilding, blocks are a heavy item of expenditure, and few qualified estimators would overlook them in such a yard; but they are also a charge, more or less heavy, against other engineering constructions, and must not then be forgotten. The estimate should be only for the extent of destruction and deterioration anticipated, and not for the full value of those employed. The possibility of such a blunder is greater in small structures than in large ones; where the number of blocks employed on a job is great the inclusion of the whole value of them in a single estimate could only arise through gross carelessness.

Sundry stores have frequently to be added to save inconvenient detail, and care must be taken not to duplicate weights in such cases.

Scrap metal should be deducted in instances where materials have been charged at full weight without allowance for it, as in the case of plates taken at their ordered dimensions, but which afterwards undergo

punching and shearing. Scrap should, however, be deducted at its price in that condition, and not at the purchase price of the metal.

By adding the two money columns, "Cost of materials" and "Wages," together we arrive at the estimated net cost of the work.

Establishment Charges.—The question of establishment charges is a difficult one. It is evident that they must fluctuate with the amount of work in progress, and yet no effect can be given to such fluctuations in the charge for the product. A customer will not pay more for a machine because the manufacturing yard is only half full of work, and the engineer who indulges any such expectation will show himself a very bad commercial manager. He must reduce the ratio by increasing the work in progress.

There can be little doubt that the percentage of establishment charges should be calculated on wages, and not on materials and wages or materials alone. Materials do not merely vary in price, but also in the condition in which they are bought; sometimes being purchased in the crude state and at others in the condition of finished fittings and forgings ready for erecting in place. When variations of this kind occur (and all engineers know that they do occur), and when stores are purchased on which the machine tools of the firm never pass, it is almost impossible to maintain a true ratio between establishment charges and materials; the more correct way undoubtedly is to distribute them according to wages paid.

Now there are three constituents in the charge for use of machinery and tools, viz. :

1. The interest on the capital expenditure for machinery and tools. Such expenditure must be taken at the balance appearing in capital account, after allowance of depreciation to date.
2. The amount of current depreciation as detailed in the cost accounts. Such depreciation should reduce the value of the respective machinery and tools to scrap price at the end of their respective lives.
3. The amount of current repairs, not being in the nature of renewals, sufficient to prolong the useful lives of the tools, &c., to the longest possible period.

The sum of these three items will be the charge for machinery and tools. But to avoid the inconvenience of

making a distinct calculation for each estimate, they should be reduced to a percentage each year: the annual stocktaking will be a convenient period for doing this, as the completed cost accounts will then be available for reference.

The wages expected to be paid must be estimated thus:

On contracts already accepted they will amount to	£9,000
On machines to be made for stock they will amount to	4,000
Tenders have been rendered, and are expected to be accepted, on which they will amount to	3,500
	<hr/>
	£16,500
	<hr/>
The interest (1) is	£450
Depreciation (2) is	230
Repairs (3) are	150
	<hr/>
	£830
	<hr/>

This will give an amount equal to 5·03 per cent of the estimated wages to be added to any tender rendered.

The remainder of the management charges, such as general salaries and wages, rent, rates, insurance, coal, lighting, water, &c., should be ascertained in the same manner, and apportioned as a percentage over the same amount of wages.

In the management charges nothing must be included for the personal withdrawals of the proprietor (if a private concern), or for fees and other emoluments to directors in excess of that which would be paid by any other firm for equal management services.

Interest is a difficult problem, and it is probably better to include it in the profit, except such portion as is already estimated for interest on machinery and tools; and, in cases where the works are the property of the firm, four per cent on the cost of land and buildings in lieu of rent. In the North of England a system has grown up of debiting trade account with interest, generally at five or six per cent, on all capital before arriving at the profit. This, however, introduces an unnecessary complication, in the financial advantage which one firm may possess over

another through the nice adjustment of working capital to its necessities. As such advantage does not in the least concern or benefit the customer, whose only desire is to obtain the best possible construction at the lowest possible price, it should certainly not be permitted to interfere with the estimate, at least not until after the figure of total estimated gross cost has been arrived at.

It must be remembered that these establishment charges and wages are essentially problematical, and there is great difficulty in arriving at a correct ratio when they have to be anticipated for so long a period as twelve months. The cost accounts of the firm, which furnish actual results, are therefore most valuable for checking them: they give the percentage which has been incurred during the previous twelve months, and with very little trouble the same information may be obtained from them for the current period at the end of each six or twelve months, without the labour of stocktaking.

Profit.—The last item on the model estimate is profit. The profit on catalogue machinery is determined, as we have already seen, by the prices charged by competing firms, which are well known. The profit on general contract, is limited in like manner by the prices which other firms will accept, but which prices are generally unknown. The minimum price which can be accepted, with any pretence to safe and sound trading, is the total estimated gross cost; the amount to be asked beyond this is modified by many purely commercial considerations. One of the most important of these is the necessity for keeping the machinery and permanent staff fully employed, so as to reduce the rates of establishment charges to the minimum. Then comes the condition of the market, although in certain states this may become the paramount consideration. As the market for materials purchased is always in a state of unstable equilibrium, or rising or falling from one such state to another, so is the market for finished materials. If it is rising, and general conditions indicate an advance in prices likely to be maintained for some time, it is possibly better to let machinery remain idle for a week or two, and wait the flowing tide, than to accept present prices. This, however, is a question which can only be determined by close observation of markets, and of the manifold conditions affecting them, and not on any abstract principles. And thirdly, it must be

remembered that whatever doubts and difficulties beset the mind of the manager of any particular firm, his competitors equally suffer under the same difficulties. In such case the victory is to the man who makes the fewest blunders.

Estimates Sent to Customers.—The estimates so far dealt with are only for the use of the firm in their own offices. There is some ambiguity in the use of this word “estimate;” it is sometimes used for the calculations of anticipated cost of work, as it has been in these pages; and at others it is employed for the specifications and tenders sent to customers. The term “tender” might more properly be used for the latter documents, but the matter is not of great importance, and as verbal correctness of expression is not so essential in engineering as in metaphysical philosophy, ordinary usage may be conformed to.

But it is of great importance that the actual sending away of the tenders should be properly dealt with. First, it is essential that time should be considered, for time is frequently of the essence of the order. It has already been said that a clerk in the office deputed for the work can furnish catalogue quotations; and it is almost unnecessary to insist that such quotations should be sent off the same day the application is received, unless some exceptional circumstances prevent it. In the case of tenders for which estimates have to be prepared, the letter from the applicant should be suitably acknowledged on the day of its receipt, and the completed tender sent away immediately it can be got ready. Advertisements for tenders frequently specify the date on which they are to be rendered, and this date must be rigidly observed; attention is rarely given to any received after the specified time, more particularly if the intending purchasers are municipal or government authorities. It is annoying at any time to lose a coveted contract, but it is particularly galling to lose it through neglect of punctuality and ordinary attention to specified conditions.

The tender should always be dated, and it is desirable to use paper headed with the firm's name and address. Foolscap is the most suitable size, though some firms use large letter paper for the purpose. Only one side of the paper should be written on. It should commence by giving the name of the person, firm, or authority to whom it is rendered; and the conditions as to delivery, whether at

works, free on rail, or free on board, and also as to erection, or any supplementary work to be performed at the destination.

The details of the machine, engine, or work should be carefully and accurately expressed. Here again arises a distinction between catalogue machinery and other engineering erections or work. The former can be copied from the list kept in the office by any correspondence clerk of ordinary care and intelligence; the latter can only be described by a technical expert, unless the firm is prepared to incur the risk of loss through ignorant blundering. As few engineers will care to run this risk, the descriptive portion of the tender should be drafted in the drawing office, subject, in all important contracts, to revision by the general manager before it is written out or typed to send away.

Particular care must be taken to mention the exact amount of work to be performed in the removal of any old machinery, and the labour which the purchaser has to provide either in removing the old or erecting the new machinery. This point is of great importance in government or municipal contracts, for, strange though it may appear, official red tapeism is usually strained to its utmost limits against the contractor when any disputed questions arise.

The amount of the tender must be fixed by the general manager, either with the express sanction of the directors, or, in minor contracts, on his own delegated authority. It should be written in *words* as well as in figures.

Tender Copybook.—All tenders should be copied in a special press copy letter book, which should be kept in a locked drawer in the manager's office, to which only the manager and accountant have access. This is better than a locked book, as the latter is frequently out of order, and the privacy of it destroyed.

The office estimates should in like manner be filed in a locked drawer in the manager's office. A Ceres file may be arranged in such a drawer for the estimates (and it will be found most convenient for the purpose) and a space also left for letter copy book.

Pursuing Tenders.—All tenders should be kept under observation, and judiciously canvassed, until such time as all hope of securing them has expired. For catalogue tenders this is a mere matter of routine. If the firm have

a traveller on the round, he must be notified of the enquiry and the reply, so that he may call upon the anticipated customer: where a resident agent has the monopoly of the district he must in like manner be advised of the possible customer. A courteously worded reminder (written or typed, but certainly not printed) must also be sent, after sufficient lapse of time, from the head office.

There is more difficulty with special tenders, and although travellers or local representatives may sometimes suffice for the purpose, it will frequently be advantageous to use the personal influence of the partners or directors of the firm, or the personal solicitation of the manager. In the case of government contracts, particularly for the Admiralty or War Office, no ordinary representative must be permitted to approach the officials. They love deference and Latin tact, and skilful humoring of their foibles will frequently determine a contract.

Tender Index Book.—To facilitate reference to tenders sent out and quotations given, an index book should be kept. It is most convenient cut into ledger index form, for alphabetical indexing of the names of the customers and others to whom they are sent, but when the tenders are entered consecutively an index should certainly be added. The book should be ruled to the following or other like pattern, and a firm red ink line drawn between each entry.

INDEX TO TENDERS SENT OUT.

Date of Tender.	Name.	Reference to Letter Book.	Description of Machine or Work.	Estimated Gross Cost.	Tender Price.	Conditions of Payment, and Remarks.	Result.

No more time should be wasted in filling the particulars in this book than is absolutely necessary for the purpose of facilitating reference; any details required can be obtained from the press copy letter book with very little trouble.

and it is useless occupation of a clerk's time to re-copy into such an index the full details of every specification and tender sent out.

If the two money columns are filled in, the book should be kept under lock; if it is intended to be left open for general inspection, then these columns should either be omitted or left blank.

The index to tenders sent out is required for general engineering and contracting factories, but is not so essential for those which chiefly manufacture goods for stock, and sell from stock at fixed, or nominally fixed, prices. Even to such manufacturers it will sometimes prove convenient, and the trouble of keeping it will not be great if the description column is curtailed.

The results of the tenders should be noted in this book as they are ascertained. It is also convenient to mark them with blue pencil in the press copy tender book.

Estimates and Commercial Records.—There is no interlocking connection between estimates for work, or the tenders founded on them, and the commercial records of the firm. It is not convenient to make any entry of them in the ledgers, nor indeed could any such entry be of service, since it would merely be a diary record, and would not in any degree affect the profit and loss account or balance sheet. And yet, in the preparation of the balance sheet and the directors' report thereon, the undetermined tenders must be taken into consideration by the board, although not by the auditor. This is particularly the case where the manager and selling agents are energetic, and every effort is being made to stimulate the turnover. It is a question of future polity, not of past profits, but none the less of some consequence to the firm. With a considerable amount of work under tender, more especially if likely to be under successful tender, it is important that the directors should consider whether their machinery and equipment and working capital are sufficient to compass, on the most economical terms, the efforts they are making, or whether the time has arrived for proposing to the shareholders the raising of additional capital. Indeed, it is probably desirable that the index book to tenders sent out, should be produced to the board for inspection and consideration once a month.

Orders Received.—It is certainly more important to secure orders than to record them, yet the latter work

must not be neglected if the office duties are to be carried on without unnecessary trouble and irritation. Orders received from customers should, for security and convenience of reference, be filed separately from other correspondence; pasting in a guard book is a very good method when it can be adopted. There is not much difficulty when the orders are for standard machines, and do not involve reference to long specifications and previous correspondence. Where, however, they are the result of previous negotiation, the outcome of specifications prepared by the tendering firm, and possibly amended by letters passing between the two contracting parties, and by interviews and conversations between their managers or representatives, the case is one of greater difficulty. And it is just in these latter orders that after disputes, and inadmissible demands, are most likely to arise. It is therefore necessary that not only the order itself, but also all the correspondence amending or altering it, should be readily available.

Under no circumstances should any pages be removed from a letter copy book; it is as suspicious a proceeding as cutting away the leaves of a ledger or cash book, and will be so criticised in the event of any after dispute. Indeed, we may add, that in some countries it is a criminal offence to mutilate books of record or of evidence in this manner. If the order is therefore founded on a specification prepared by the tendering firm, either a complete copy of it must be made, or a memorandum giving reference to the number and page of the copying book where it is to be found. To this must be annexed copies of any letters to the purchasing firm, and either copies of, or original letters from them, which in any way modify the original specification. When the letter giving the order, or intimating acceptance of the tender, is attached, the order will be complete. In such condition it can either be pasted in a guard book or filed in a Ceres or Shannon file, having first been distinctly marked with the number appropriated to it in the register.

Orders Received Register.—It is necessary that the orders should be registered, both that they may readily be found after lapse of time, and that they may each be furnished with a distinctive number or denomination, which distinction it must carry throughout all subsequent transactions and records. The commercial office will receive the first intimation of the acceptance of the tender; that is, it will come to the manager in the ordinary course along

with his other letters. If approved by him (for it must be remembered that in such an acceptance conditions may be annexed which cannot be agreed to) it will be passed to the clerk in the general office who is charged with the care of the register of orders received, to be by him completed in manner aforesaid, and then registered.

The entries should be consecutive, to avoid the danger of duplicate numbers. An index of customers' names must be provided, which must be promptly entered, and give reference to order numbers, not pages. The book should be of stout hand-made paper, and strongly bound, so that it may be in good condition after many years' hard wear. Various forms of ruling may be used, but the requirements of most firms will be met in the annexed specimen. It will be convenient to have the pages divided into spaces by horizontal red lines, and the consecutive numbers printed in each space: this increases the cost, but is a safeguard against wrong numbering.

REGISTER OF ORDERS RECEIVED.

Left-hand page.

Order No.	Date of Order.	Name.	Description of Goods Ordered, or Contract.
5746			N.B.—This need not be in great detail, as the book is a register to enable a speedy reference to be made to original documents.

Right-hand page.

Contract Price. £ s. d.	Conditions of Payment.	How delivery to be made.	Dates when deliveries made.	Remarks.

In some instances columns are provided for cash and bills received, and also for charges for any extras provided, so that the register may show the financial condition of any order or contract completed or in progress. This, however, is merely duplicating information already available in the ledger, and increases the office expenses; whilst the

writing up of such columns is frequently neglected or deferred by the staff, who are perfectly aware that they are unnecessary. There is a further and greater objection to it. The register of orders has frequently to be inspected by men who would not be permitted access to the ledgers: it is undesirable that they should be furnished through its pages with just the same information which they could get from the ledger, respecting the payments made by a customer. It is not the title of a book, but the nature of its contents, which makes secrecy necessary.

Recapitulation.—In the second division of the commercial management of an engineering establishment, the sales department, the steady succession of orders is necessary for successful management; and continuity of work, steadiness of employment for tools, and progressive, but permanent development of the business of the firm, are ends which must be constantly kept in mind by the engineering manager. There are several means which may be adopted, either independently or in conjunction, but in the proper use of them considerable discretion will have to be employed. They include advertising, circulation of catalogues, employment of travellers, personal solicitation, and the good reputation of the firm; and whilst they may all be used, no certain rule, applicable to every case, can be laid down. Their efficacy frequently depends upon courtesy and tact, as well as on engineering skill or excellent work. To secure orders and their continuity it is needful to have proper arrangements in the general office, and the clerk most immediately concerned with this portion of the work is the correspondent, who is responsible for the replies to the numerous letters and inquiries received. His position is a confidential one, and it is needful that he should have a special capacity for keeping inviolate the private information entrusted to him; but as he has to act under the definite instructions of the manager, he must not be permitted to usurp authority in the office or works, an usurpation which would not be for the benefit of the firm. He must be methodical, both in his registers of letters, of addresses, and of postages, and also in his distribution of letters, and answering them in accordance with dictated replies. To some applications for quotations of prices he can reply at once, having merely to send a catalogue, or extract from a catalogue, but other letters, even for standard machines,

will demand the attention of the manager, since they really ask for a reduction in price, and amount to a "higgling of the market." This is particularly the case with foreign trade. But, in general, letters of this kind involve the preparation of estimates, and in considering these we are confronted, in machine designs, with avoidable difficulties created by want of a scientific nomenclature of details. An attempt at solving this perplexity has been made by the Ferracute Machine Company, of America, whose method is deserving of consideration, if not of adoption, by English engineers. Estimates for catalogue prices necessitate averaging the cost of materials, and also require the establishment charges to be entered at a percentage which would be correct if the yard were full of work. The difficulties attending estimates of a more general and competitive character are, however, greater. Of three methods which may be adopted for preparing them, the one which yields the most satisfactory results, and is therefore most worthy of examination, is the careful calculation of anticipated cost of materials and labour, with such amount added for profit as it is considered the work should reasonably yield. In this calculation labour and materials should be separated. The weights and quantities should be furnished by the draughtsmen, who are now sufficiently skilled experts to render any blundering therein inexcusable. The prices are to be cost prices in the open market, as nearly as can be ascertained by enquiries and published lists, but in this connection it is needful to remember the unstable equilibrium which is the usual condition of every market. A like instability attends the labour market, and is further complicated by the modern demands made by trade union leaders; it is therefore desirable that labour should always be estimated by technical experts—that is, by the foreman and sub-managers brought immediately into contact with the men, and not by office clerks. The amount to be added for profit is subject to various limitations, most of which are of commercial rather than engineering character. It is limited by the prices which will be accepted by competing firms, by the necessity for keeping the machinery and permanent staff fully employed, by the general condition of the market, and the prospects which exist of a rise or fall therein; and lastly, by the equal chaos which will exist in the minds of competitors seeking a solution of the same problem. Finally, the estimate (which so far has

been for internal office use only) has to be reduced to the form of a tender, and sent away to the enquirer, whilst the order, if an order be secured, has to be recorded in the books of the firm in a manner which will ensure ready reference to it, and to all letters or documents varying or affecting it on any future occasion. In any of these requirements and arrangements there are numerous office details, some of which may be neglected, though only at the price of considerable inconvenience, but they are also intermingled with matters of commercial import, and technical knowledge, which cannot, in these competitive days, be passed by on one side without serious detriment to the prosperity of the firm.

CHAPTER XII.

DRAWING OFFICE ORDERS FOR WORK. STOCK ORDERS. DRAWING OFFICE ORDER BOOK. DRAWING NUMBERS.

Drawing Office Orders for Work.—We have, however, now reached a portion of the subject in which it will be apparent that design, construction, and management and control of workmen, are of such supreme importance that it is necessary mere clerkism should be relegated to a secondary place, and all working arrangements emanate from the scientific portion of the staff. Theoretically, the originator of all workshop movement should be the manager, but he can only be practically so through the medium of his staff, and by a proper delegation of duties and authority to them. Such delegation must, however, be within the strict meaning of the word; it must be an appointment to act as a deputy, and not a cessation of decent order and method. To ensure methodical record, or even methodical progress, it is needful that all orders for work should proceed only from one office, and that office should undoubtedly be one of the technical offices of the establishment.

The draughtsman has already been referred to as “the *aide-de-camp* and most trusted ally of the manager,” and, this definition granted, it naturally follows that all orders for work should be issued through the drawing office. Every detail of the design has to be planned there, and plotted out on drawings to which the actual construction must strictly conform, and the draughtsmen have therefore a more complete knowledge of the necessary requirements than any other of the working officials.

Of course, in large works, the technical department may be differently constituted, and a chief may be appointed to it, holding the position and authority of deputy or assistant manager. This, however, is only a modification of personality and title; it is one of those variations of practice which cannot be entirely anticipated in any general treatise.

Stock Orders.—When the firm manufactures and warehouses a number of machines or articles of various sizes, ready for delivery as required, a slight modification of the general system may usefully be employed in order to save clerical labour. An order should be prepared in the following form, forwarded to the drawing office for record, and thence transmitted to the warehouseman :—

**THE CLYDESDALE ENGINEERING COMPANY
LIMITED.**

TO THE WAREHOUSEMAN189...

Please deliver the following goods :—

Order No. 5746. Drawing Office No. W.....

Name and Address

Article.....

Catalogue Number

Packing and Marks

Conveyance and Forwarding Instructions.....

Carriage Paid or to Pay

.....

Entered. {Order Clerk.
 { Draughtsman.

Forwarded per

..... Warehouseman.

A carbon copybook may very well be used for these stock orders, and if duplicate orders are sent to the drawing office one can be kept there (pasted in a guard book), and the other initialed by the chief or other authorised draughtsman, and forwarded to the warehouseman. The drawing-office numbers must be consecutive, as the orders are received and filed, and should be preceded by a large W. or W.O. to indicate that they are warehouse orders. The guard book should be indexed under the names of purchasers.

When the goods are sent away the form must be returned by the warehouseman to the general office, with date and particulars of delivery inserted.

Drawing Office Order Book.—The stock orders are interloped here because they do not pass through the

ordinary order book of the drawing office: they are a matter apart from the transactions there recorded, and indeed have already been dealt with in that book when the goods were manufactured, as will be seen later when treating of warehouse transactions. But for the due enforcement of an orderly and adequate system of arranging work to be performed in the shops, the first necessity is a drawing office order book. The order book and records in the general office are complete with specifications and variations thereof, with all stipulations as to time, method, and conditions of delivery, and arrangements as to inspections and tests, attached thereto. Complete copies of these papers must be prepared by the general office, and sent to the chief draughtsman with a docket attached:—

ORDER No. 5746.

Date.....189...

Name

Delivery.....

Forwarded to drawing office on.....189...

It is both unnecessary and undesirable to give any particulars of prices or terms of payment, as these do not concern the drawing office; the clerk who prepares the copies (or extracts) should be taught to do so with intelligent discrimination.

The form of the book may be varied, but it is essential that it should contain certain specific information which will show the exact position of any order, so far as the technical department is concerned. It should be written up daily, with as great regularity and exactitude as a cash book is entered by a competent cashier; and the writing should be invariably clean and neat. It is a permanent record, which will be frequently and constantly referred to for many years, and should be kept in a manner worthy of the office which, before all things, ought to be distinguished by neatness and accuracy.

The book will suffer great wear and tear, and should therefore be of good hand-made paper, not too light in weight, and strongly bound. It will be found conducive to legibility if the various lines of division are ruled in red. The following model form will explain what is essential to it, and to avoid increasing the size and cumbersomeness of the book it is better to use the right and left hand pages for each order.

DRAWING OFFICE ORDER BOOK.

Left-hand page.

Order No.....

Page 1157.

Date of Order.....189...	Name of } Customer }
--------------------------	-------------------------

Particulars of order

Date of Delivery.....189...

		Tracings Received.	
		Tracings Sent Away.	

Dates of issue of instructions, shop orders, &c.,.....

Right-hand page.

Page 1157.

SHOP DRAWINGS REQUIRED.

Shop Drawing Numbers.	Description.	Date Sent into Shops.	To Whom Sent.

Drawing Office Notes.

Foremen's Advices.

Completed 189...

Tested 189...

Delivered 189...

The order number will be that given to it in the general office order book, and marked on the docket; No. 5746 in the specimen given. The drawing office order book should be folioed, not paged, for convenience of indexing. The indexing will be best on the dictionary system, which gives both machine or other contract name, and purchaser's name; although this entails two, or sometimes three, entries instead of one, the convenience of it in future searches is very great. The date of order and name of customer are also obtained from the docket, always assuming the latter to be correctly filled up.

The particulars of order must be in sufficient detail to enable the draughtsman or manager referring to it, to readily appreciate any peculiarities of design or variation from previous models. Here, again, differences in the class of work undertaken by the firm will modify the wording of this portion of the order book. A shipbuilder, for instance, will seldom construct above one replica, if indeed one, of a previous ship; whereas a toolmaker will produce scores of lathes the exact counterparts of those previously made, even when he does not make them to stock. The "particulars of order" will therefore usually demand greater detail in the former class of work than in the latter. No attempt must, however, be made to copy the specification here, nor even to insert a copious abstract giving ordinary details: there is not space for it, and it would also be a waste of time when there is a copy of the specification itself to refer to. The date for delivery should be given, so that a reference to the page may not only display the present position of the order, so far as the drawing office is concerned, but also the date fixed for completion.

There are spaces for "tracings received" and "tracings sent away," each divided into four columns, the first being for the date of receipt or forwarding; the second for the name of the firm or person from whom received or to whom sent; the third for particulars of the tracing; and the fourth for the registered number. In some of the larger structures the tracings passing between contractor and purchaser are so numerous that no ordinary apportionment of space would suffice for recording them. We have known a dozen tracings and suggestions sent to the Admiralty, for a scarp in the stern post of a composite vessel, before one was finally approved, and many engineers

have to suffer similar difficulties with some of their customers who have particular fads as to arrangement, or who desire to introduce an excess of power or tools into a limited space. A record book should be kept in the office for all tracings sent away, and only such (whether received or forwarded) as furnish finally approved modifications of the original design, and such as are sent to sub-contractors, should be entered in the order book.

The spaces for "Dates of issue of instructions, shop lists, &c.," and for "Drawing office notes," explain themselves. The former will enable the chief draughtsman to see immediately whether the shops are being supplied with the information which they require from his office, and show him whether the draughtsman in immediate charge of the job is keeping his work up to time. The drawing office notes inserted in the order book should only be those of permanent utility, as it is not intended that this book should by any means be a mere memorandum record.

The space, "Shop drawings required," should be entered up as soon as possible after receipt of the order, so that the draughtsmen may at any time ascertain what are required, and take steps for preparing them. The description column should be completed with *all* the drawings which are known to be required; others which may subsequently be wanted must be added from time to time, as the necessity arises. Then the column, "Shop drawing numbers," must be filled up with all the drawings which are already in existence, which in the case of machines of general type, and of standard patterns, may probably be all in the list. When this is done the other drawings wanted will appear as blanks in the first column, and must be proceeded with in the usual office course.

The two last columns will show what shop drawings have been actually sent into the works, and what are required there at any given date for further progress on the job. A general examination of the book should therefore prevent any work in the shops being avoidably delayed through the laches of the technical department.

The foreman's advices are merely dates when the machine, or other work, is completed, tested, and forwarded; the latter date being, of course, furnished by the warehouseman, and not by any of the shop foremen. It is the date of actual delivery which is wanted, and not

the date when the goods are sent from the constructive shops to the warehouse. None of the dates really concern the drawing office, unless the chief draughtsman is also deputy or assistant manager, or in some way discharges the duties of works' manager, but the drawing office order book is so extremely useful for further reference, that it will be a great convenience to have them inserted. All reports of this kind should be furnished in writing, as verbal statements are frequently neglected, and sometimes give rise to disputes which it is desirable to avoid, both in the interest of discipline, and of the good fellowship which should exist among the various officials.

Shop Orders and Lists.—Whether it is desirable to issue orders for work to be done in the shops, apart from the details of the work contained in what are sometimes termed shop lists, is a moot point with engineering managers. Many firms formerly issued a sheet of general instructions to the foreman in whose department work on the job was first commenced, which sheet was to be transferred from shop to shop along with the machine or other work under construction; whilst at the same time the various foremen were furnished with memorandums, more or less detailed and complete, of the work required to be done in their several departments. The sheet of general instructions was used in such cases as a prime cost sheet, the time of the men employed, and the materials consumed in the work, being entered on the back of it. This system is still in vogue in many small factories, but the larger firms have long abandoned it, at least so far as the cost accounts are concerned, in favour of more elaborate systems. It, however, seems possible to combine in one form the shop or works order, and the shop list, and as the abandoning of any office forms or routine which can be safely dispensed with has a tendency to promote simplicity, this single form appears to be the more desirable practice.

Form of Shop Order.—The sheet must, however, be very complete, so as to afford the foremen all the information they could obtain from the works orders and shop lists when both were employed. It is better to have the sheets printed; good machine-made paper, tough in texture, should be used, as the orders will frequently receive some rough usage in the works. The accompanying form appears to serve the purpose.

SHOP ORDER.

Order No. 5746. Draughtsman.....

Particulars of machine.....

.....
.....
.....

NAME PLATES.

Makers..... | Customers.....

	Shop Drawing. No.		Shop Drawing. No.		Shop Drawing. No.
.....		
.....		
.....		
.....		
.....		
.....		

Parts to be supplied from stores, or from other
makers
.....
.....

Patterns required.....

.....
.....

General remarks.....

.....
..........
.....189...

Chief Draughtsman.

A copy of this list must be sent to the works manager, to each foreman who will be engaged on the order, to the pattern maker, and the storekeeper. If a warehouseman is entrusted, apart from the storekeeper, with the delivery of goods made to order, then a copy must be sent to him also, so that he may check off the several parts of the machine as they come in from the shops, and satisfy himself that it is complete before it is sent away.

The order number will be that given in the general order book, and which, as we have already said, must follow the order all through its career. The name of the draughtsman in charge of the work must be written at top, so that the foreman may be under no misapprehension as to whom they are to apply in the drawing office. The particulars of the machine, &c., must be general, such as indicate its character and size, and also any special peculiarities to which it may be needful to draw attention. Beyond this it is not necessary to go; if it is absolutely requisite, a copy or an extract of the specification must be attached for the information of the foreman or foremen requiring it.

Name Plates.—The exact wording of these plates must be given, and also the dimensions, and where special design is required a sketch of it should be attached.

Shop Drawings.—The whole of the shop drawings which can, by anticipation, be assumed will be required, should be inserted in this portion of the order, both by description and number. It is probably that only a portion, and in some cases a very small portion, of them will be ready to accompany the order, but the record, on the face of it, of those which are to follow, will enable the foreman to see what he is to expect, and so not only to plan out his work, but also to prevent delay through waiting drawings for any portion of it.

The “general arrangement plan” will appear among the shop drawings, but not necessarily for circulation among the foremen. In many cases it is better to confine it to the works manager, or the principal foreman; in others it may be desirable to let all the foremen have access to it. The determination of this is largely a matter of internal discipline and arrangement, and will be materially affected by the character and status of the officials, and by the class of work under execution. Under no circumstances

however, should the general body of the workmen have free access to these ultimate plans.

Parts to be Supplied from Stores or Other Makers.—

This portion of the shop order should be as complete as possible, both to facilitate the arrangement of work in the shops, and to enable the foreman to prepare his stores requisitions in sufficient time to avoid delay in delivery from the makers. Special parts of machinery, and also material of special dimensions or form, should be ordered from the drawing office, as already explained, and in such case, a remark that this will be done should appear on the face of the shop order.

Patterns Required and General Remarks.—Under the head of patterns required, not only must particulars of any new patterns be inserted, but also the numbers of any standard patterns which will be required for the job, and of any which can be altered to suit, so as to avoid making entirely new ones. Alteration of patterns is, however, so frequently of doubtful advantage, and depends so much on the condition of the pattern, and the difficulties it may present to the workman altering it, that no instructions of this kind should be inserted in the order without previous consultation with, and advice from, the patternmaker.

The general remarks are intended to draw attention to any special features of the machine, or any stipulations in the order or contract, which are not, and cannot be, sufficiently or properly explained on the face of the drawings. Where the contract specifies that the work shall proceed under inspection, or that it shall be subject to tests which shall be conducted in the presence of the purchaser or his agent, a notification of the condition should here be made. The shop foreman thereby affected will be responsible for advising the drawing office when the work is sufficiently advanced for such tests.

The orders must be dated and signed by the chief draughtsman before they are issued.

It will be observed that no provision is made for recording time and material on the orders for costing purposes, nor are they in any way interlocked with the commercial or cost accounts of the firm. These are compiled from other records, equally essential, but devoted to financial and cost purposes alone, and no useful end will be served by muddling together on one sheet, or in one

set of books, technical instructions for work to proceed, and an abstract of the cost incurred in executing it.

Supplementary Shop Orders.—It will sometimes occur that an alteration has to be made in a shop order after it has left the drawing office, or additional drawings and instructions have to be added. This may be done in three ways :—

First, by issuing a supplementary order on a similar form to that used for the original one, marking it at the top, after the words shop order, with the additional designation "Supplementary."

Second, by issuing the additional instruction on an ordinary memorandum form, also marking it at the top with the order number, 5746 or as the case may be, and also with the words "Shop Order—Supplementary."

Third, by recalling the original orders, and correcting them in red ink.

The adoption of one or other of these methods will be largely determined by the local environment, and the suitability of the one adopted to the particular instance dealt with. There is no especial reason against using all three in the same works for various orders, care being taken that the order number always appears on the amending sheet.

Shop Order Copy Book.—Copies must be taken in a press copy book, kept in the drawing office, of all shop orders which are issued, whether they be original or supplementary. In any instance where the third method before referred to is used, the copy book must be amended in blue or red lead to correspond with the re-issued order.

Registration of Drawings.—A glance at the shop order will show that the most important portion of it will generally be contained in the space which gives the shop drawing numbers. These drawings are the real instructions to the foremen and workmen to proceed with the work. These drawings are the real specifications of what work is required to be done, and should contain within themselves all that is necessary to be known respecting it. The parts to be supplied by the stores, or by other makers, are supplementary, and generally of secondary importance to the work to be executed in the shops, whilst the drawing office notes should be few in number, and ought never to be used in lieu of proper

completion of the drawings. And, as in many establishments the same drawings may be used over and over again for repeat orders, whilst in others they will be often referred to, and employed as examples for constructions similar in design but differing in size, and modified in some details, it is essential that there should be some ready method of finding them. It is true that when the order number is once found, all the shop drawing numbers affecting it are obtained in the space devoted to that purpose; but beyond the difficulty which sometimes arises in finding the particular order wanted, it must be remembered that drawings are frequently prepared in advance of orders, and sometimes indeed prepared for tenders which never secure acceptance. Such draughtsmanship may therefore not appear in the order book at all, or at least not until after some delay, and thus there is a possibility of trouble and delay arising through the hunt entailed among unrecorded and unnumbered papers. It is necessary to have some further index, which shall comprise all drawings, if loss of time and temper is to be avoided. It is well to remember that small obstructions and trifling annoyances are more destructive of life's energies than greater obstacles, and it is therefore desirable to remove them out of the way as much as possible. Draughtsmen in a certain sense are artists, and frequently share the impatience and irritability of temperament which accompanies artistic genius.

Drawing Register.—The register of drawings should consist of two parts, the index and the register proper. The former is necessary to facilitate reference to the more detailed information contained in the latter portion of the book, for such a reference may be wanted many months or years after the drawings have been prepared, and when the searcher has only a hazy memory of their date. The index should, of course, be alphabetical under machine or other structure titles, and it is probably better to use a separate book for the purpose, of ample dimensions, which may serve for several registers. It should be specially ruled in the following manner, so as to furnish date and description of the drawing required, and the number of the register. The "Ceres" or other like system of cards may be used for this index, instead of a bound volume; but as it has to last for many years, it is probably inexpedient to risk the loss of some of the cards. The index must not only be complete, but it must be permanent in its completeness.

Date.	Description.	Drawing Reference.
	Lathe-chasing, 8 in. × 5 ft. bed, open spindle ...	
	„ „ 9 in. × 6 ft. 6 in. bed „ „ ...	
	„ „ 10 in. × 8 ft. bed „ „ ...	
	„ „ 8 in. × 4 ft. bed, hollow spindle..	
	„ „ 7 in. × 16 ft. bed, „ „ ...	
	„ „ 6 in. × 14 ft. bed, „ „ ...	

Drawing Numbers.—Before the form of register can be decided it is necessary to determine the method of numbering, or otherwise earmarking the drawings. It is absolutely essential that the marking should be perfectly distinct, so that there may be no confusion of one machine with another, and it is also needful that all detail drawings should bear on the face of them the number or symbol adopted for the general arrangement plan, with a subsidiary number or mark for the detail sketch. We will first consider a method frequently adopted, with more or less variation to suit the fancies of the draughtsman, for this purpose.

The drawing numbers should be in numerical progression from one upwards, whatever description the machine, engine, or contract may be. On the general arrangement plan (or plans in such complex structures as steamships) the progressive number should, for the sake of distinction, be preceded by a bold D, thus,

D 1147

The same number must appear on all shop or detail drawings, with another number underneath to mark the particular portion of the work which it represents, which latter number may conveniently be preceded by the letter S. So, the twelfth detail or shop drawing of the general plan referred to above will be marked

D 1147

S 12

There is thus an inseparable connection between the general drawing and the shop drawing, which in practice will be found infinitely more convenient than the use of duplicate sets of numbers, or the keeping of two registers.

The drawing number is sometimes divided into two parts by a line or decimal point in order to indicate the special cupboard, drawer, or other receptacle in which it is.

to be found. Thus, the drawing before quoted might be marked D 11·47 or D 11/47, signifying that it is drawing 47 in drawer or shelf No. 11. This, however, is an objectional complication, which not only increases the possibility of wrong filing, but gives considerable trouble when any re-arrangement of drawers or cupboard is undertaken. It serves no useful purpose; any little advantage which might be obtained from it can be equally secured without the disadvantages by placing labels on the drawers, which are easily removed or amended, and it had therefore better be avoided by any draughtsman or manager who wishes his own peace of mind to be undisturbed.

Pattern Numbers.—It is equally desirable to connect the patterns in the shop with the dominant drawing as it is to identify the detail drawings with it. The pattern should therefore have on it a label bearing the progressive number, the same as the shop drawings do, but with a subordinate number preceded by the letter P, or a progressive letter, instead of the S number previously mentioned. If there is a pattern required for the detail named in shop drawing $\frac{D\ 1147}{S\ 12}$, it will be marked

$$\frac{D\ 1147}{P\ 12} \quad \text{or} \quad \frac{D\ 1147}{L}$$

By thus numbering the patterns it will always be possible to select from the pattern store those required when once the number of the drawing is obtained; and this can easily be done if the drawing office register is properly kept.

Form of Register.—We have now to collect into a convenient focus all these various references; in a book which, whilst giving the numbers, will also contain a sufficient description of the machine or engine in question. The most convenient size for the book is foolscap, and it should be of hand-made paper, strongly bound in Russia leather or vellum. Large books are cumbersome, and should be avoided whenever smaller ones can be contrived to serve the purpose, whilst a cheap book made of poor paper and indifferently bound will be a constant source of annoyance when used for such a purpose as this. A folio should, in general, be allotted for each set of drawings, so that ample space may be left for the details; it is only in a few cases that two sets can be got on the same folio. The ruling will be as follows:—

Left-hand page.

Right-hand page.

No. OF DRAWING—D 1024.

General description :—

Pair of beam condensing
engines, automatic gear,
controlled direct by
governor.

Cylinders **X**
N.H.P.
I.H.P.
Boiler pressure lbs.
Revolutions

Description.	Shop or Detail Drawing Numbers	Pattern Num- bers.	Remarks.
Cylinders X	D 1024 S 1.	D 1024 A	General Arrange- ment Drawing. Commenced 189..
Walking Beam, C.I.	D 1024 S 5	D 1024 E	Finished ....189..

The first thing which must be done in commencing a drawing or set of drawings is to fix the index or registered number, and this quite irrespective of the purpose for which the drawing is required. It is just as necessary that this number should be fixed for drawings prepared for a tender, or in explanation of suggestions made to a possible purchaser, or even in support of evidence in an arbitration case, as for those prepared for an actual contract secured, or for the working patterns of a standard machine. This number must be progressive. The register will fix the progression, if care is taken to enter the description, or so much of it as is then available, each time a number is appropriated. There is then no need to waste time and labour in keeping a list of numbers apart from the book.

The general description should give all the salient points of the machine or structure in question; as far as possible the same method should be used, as variations therein are misleading.

The column headed "description" is for particulars of detail drawings or patterns, the numbers of which appear

in the two following columns. The register will thus give the numbers of the general arrangement drawing (D 1024) of the various shop or detail drawings, and of the several patterns. The space for remarks will allow of any revised or amended drawings or patterns being noted therein.

It is convenient to insert the dates of commencement and completion of the general arrangement drawings, but it is neither necessary nor desirable to extend this to the detail drawings and tracings. It is quite true it is done in some offices, but this is reducing a book of permanent record to the character of a drawing office diary, and one also of a very imperfect and useless description.

It will be noticed that the order number does not appear in this register. In some cases there is a very sufficient reason for its absolute omission; in the case of drawings for standard patterns of machines for the construction of which, either on effected sale or for stock, orders will be constantly issued, it would be absurd to insert the first order and omit the others; whilst to note all of them would probably require a substantial addition to the size of the book. In the case of special structures, such as an iron or steel bridge, or a steamship, it may possibly be convenient to keep a record of the order in the drawing register, and this can easily be done in the remarks column; common sense and a sense of the fitness of things must be the draughtsman's guide.

CHAPTER XIII.

ALTERNATIVE PLAN OF REGISTER. ALTERATIONS OF DRAWINGS AND PATTERNS. FILING DRAWINGS.

Alternative Plan of Register.—Where numbers are used, they should undoubtedly be progressive, as already explained, and only one series should be employed for all the various manufactures of the firm. It may seem at first sight convenient to have separate number series, distinguished by some marks or letters for different classes of machinery, but in actual practice this doctrinaire suggestion will be found productive of much trouble and waste of time. Drawings will frequently be filed in the wrong series of numbers, and the search will not add to the “sweet reasonableness” of the draughtsman.

There is, however, an alternative method to that of progressive numbers, which appears to have many advantages to recommend it: it is the symbol system of the Ferracute Company, of New Jersey, already described under the heading of “Nomenclature of Machine Details.” It is essential, for the efficient working of this system, that the symbols and numbers should be fixed by a technical expert, and not by a commercial clerk, and none of the technical officers have equal facilities with the draughtsman for the discharge of this duty. It is also essential that these symbols should be fixed before any work is commenced on the machine, before, indeed, the drawings, which are a preliminary part of such work, are put in hand, so that they may from the first bear the distinctive symbol by which they are to be known. This requires the opening of a page in the drawing register, just as the progressive number method does, but it is in a different form of register to that previously given; a form which will not only anticipate drawings required, but which will also admit of “gapping” for the after insertion of any which may have inadvertently been omitted. As it is always most desirable to prevent unnecessary multiplication of books and records, it is better to combine the symbol book of the Ferracute Company, and the ordinary

REGISTER OF DRAWINGS.

Left-hand page.

Right-hand page.

MACHINE SYMBOL, F.P.L.

Description :—

Dimensions :—

No. 3 Foot press.

Piece No.	Same as	Piece Name.	Material.	Quantity.	Weight.			Piece or Shop Drawing Nos.	Patterns Required.
					Rough.	Finished.	Aggregate Finished Weight.		
1		Frame	Cast Iron.	1	220	200	200	1	1
2		Jib	"	1	10	9	9	With 1	2
3		Side Bar	"	1	45	40	40	With 1	3
4		Front Leg	"	2	30	30	60	4	4
5		Back Leg	"	1	40	40	40	With 4	5
6		Treadle	"	1	17	15	15	6	6
7		Lever	"	1	85	80	80	With 6	7
8	F.P.H. 8.	Lever Weight	"	4	5	5	20	—	—
9		Pitman	"	1	12	10	10	9	9
10	F.P.H. 10.	Clamp Sleeve	"	2	3	2½	4½	—	—
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21		Lever Pin	Steel	1	2½	2	2	With 6	—
22									
23									
24									
25									
26	F.P.J. 26.	Treadle and Pitman Bolt	Iron.	3	¾	¾	1½	With 6	—
27									
28									
29									
30									
		Total Weight							

drawing register of the English engineering firm, whenever it can be done without raising some local difficulties. The annexed form appears to answer this purpose. For the purpose of comparison the same machine and parts are given as in the previous Table "B," taken from the company's symbol book.

The very lucid explanations of Mr. Oberlin Smith, before quoted, should render the use of this form a matter of no difficulty.

Shop Drawing Numbers.—The piece or shop drawings ("piece being a part reduced to the last condition of subdivision, or so welded or glued together as not to be again taken apart") must all bear the symbol of the machine and size, and also the number of the part. For economy sake two or three pieces are frequently placed on the same sheet of paper, and in such case the symbol and piece number must appear above the particular drawing affected. Thus, in the foot-press in question, one sheet of paper contains drawings of

The frame,
The jib,
And the side bar.

The first drawing must have placed immediately over it the symbol, F.P.L.—1; the second, F.P.L.—2; and the third, F.P.L.—3. In this instance the piece numbers are assumed to be consecutive, but they are not always so. It will be seen later that pieces No. 21 and No. 26 are on the same sheet of paper as piece No. 6. The column, "Piece or shop drawing numbers," must be filled up as they are completed, either with the number of the piece, if it occupies the whole sheet, or by a reference to some previous number, if it occupies part of the same sheet with it. Care should be taken always to make such references from the latest to the earliest number, and not up and down at haphazard.

When the second column, "Same as," bears a reference there is no occasion to make a drawing for that piece, as one is already in existence, and a pattern also, if a pattern be necessary. The pen can therefore be at once drawn through the columns for piece drawing numbers and patterns required. There is no further drawing-office work required on these particular details.

Pattern Numbers.—The pattern numbers, which must be either painted on the patterns themselves or on labels affixed thereto, will in like manner be the symbol of the

machine, and the piece number thereof, and a reference to the last column of the register will show whether any particular pattern is in existence, or has been ordered to be made. Thus, a pattern is required for the casting of the frame of the foot press, and when the needful instructions have been issued to the pattern maker, a number 1 will be written in the last column, whilst the pattern itself will be marked F.P.L.—1. The register to patterns will thus be as complete as in the progressive number example, and the patterns themselves will always remain identified with, and placed in the allotted pattern space for, the original machine for which they are constructed. Pattern F.P.H.—8 will be used for the lever weight of machine F.P.L., but when that temporary user is over, it will be placed again in the receptacle for the patterns of F.P.H.

Weights.—The three weight columns are taken from the symbol book of the Ferracute Company. They are not essential to the register, but will be found of frequent convenience.

Index to Register.—The index to the register also requires a little modification. The letters F.P. must never be used for any other machine than a foot press, and the third letter L must never be employed for any other size of foot press than that to what it was originally appropriated. The index there must be of such a character as will prevent duplication; not only must it be alphabetical with respect to the first letter, but the same arrangement must be followed with the second letter so that there may not be much danger of its use a second time. In addition to the drawing reference it is necessary to give the page in the register, which is not so much required when the progressive number is used. It certainly will be a great convenience, if indeed it may not be considered absolutely necessary, to have the index in a separate book when the symbol system is adopted, so that it may last for many years, and also that sufficient "gaps" or spaces may be left between the different machines, after the manner in which such spaces are left in the drawing register, or symbol book, between various materials and trades. Overcrowding in such an index will be fatal to its usefulness.

The register, with its index, will serve the combined purposes of the Ferracute Company's symbol book, and a register of drawings, and thus obviate the waste of time

and energy which would arise through keeping books which, in many respects, would be duplicates.

Special Contract Drawings.—Either of the methods of registration described will serve the purposes of an ordinary machine, or land engine factory. There is a little difficulty, however, with firms which construct more complex engines or erections such as ships, marine or locomotive engines, or railways. It is not merely that the register itself will become inconveniently crowded, if an attempt were made to get all the drawings for such a contract into one ordinary page, but there is also to be considered the desirability of collecting them into a distinct drawer or drawers, or cupboard, so that they may be readily found without the trouble of turning over numbers of general and irrelevant drawings to find them.

Contract No.....

For H.M.S. Acorn, composite, screw, barque-rigged.
Length, 167 ft. ; beam, 32 ft. ; mean draught, 14 ft.

Engines to be built by Maudsley, Sons, and Field, to Admiralty specification.

Date.	Description.	Drawing Number.
	Profile and general arrangement	D 642
	Deck plans	D 647
	Cabin plans.....	D 724

Contract No.....

For section A of Mexican Southern Railway from Puebla to Oaxaco.

Date.	Description.	Drawing Number.
	Survey—Puebla, to section 14	D 304
	Survey—Section 15 to Oaxaco	D 357
	Siding arrangement—Puebla	D 378
	Railway station—Puebla ...	D 391
	Siding arrangement—Oaxaco	D 397

Indeed, work of this character will divide itself almost automatically into sections, each of which will be equal, or more than equal, in number of parts and work involved to a machine tool, or large agricultural machine. It will found better, probably, to give a separate progressive number or symbol (whichever method may be adopted) to each such section, and then follow the ordinary course in the drawing register as though the section were a distinct order or contract. It is needful then to have some way of assembling the drawings for all the sections into one record, especially as the work may, in certain cases, extend over months, or possibly even over two or three years. A supplementary index is therefore useful in such cases. It may be very simple, and kept in an inexpensive foolscap book, as it will not undergo severe service. We suggest the form on the preceding page.

Alteration of Drawings.—All these careful records will be rendered delusive if drawings can be altered or amended after being once completed, without any record of such alteration being kept. The drawing-office staff should not merely be the designers for the firm, but also its historians, in the same way as the German General Staff officers compile authentic records of the movements and results of the campaigns they had previously arranged. A drawing, once completed and inked in, should exactly represent the machine, &c., as it leaves the works, and, both for the convenience of repeat orders and for facilitating the making of parts for repairs, it must never afterwards be altered in such a way as to destroy its original character.

Alteration of Special Contract Drawings.—When the drawings are for a large and complex contract, such as a steamship, or large railway or road bridge, it will seldom be found economical to alter them for a second order of a similar kind. In the former instance, the variations demanded by the owners, even after the contract is signed and the ship well on her way towards completion, are so numerous and diversified, that an altered drawing for a second ship would speedily become unintelligible. The draughtsman has generally to exercise all his skill, and all his common sense, to keep his drawing true to the work for which it is specially prepared. The best plan in such cases is to take the bull by the horns, and prepare a fresh set of drawings for the new and varied contract. In a few cases, however, some of the sectional or piece drawings

prepared for shop use may be amended and used afresh, and when this is done a record of the alteration must be made in the manner hereinafter named for standard drawings.

Alteration of Standard Drawings.—It is in these standard drawings that the greatest difficulty arises, and it is with respect to them that the necessity for a complete and lucid method of record is most evident. The original drawings are archetypal representations of work which has been executed, frequently many times over, and as the work cannot be recalled and pulled to pieces, neither should the representation be plastered over with features which did not originally appear on it. When a machine or engine has to be amended in design so that the general arrangement is altered to any material extent, there cannot be any doubt of the desirability of preparing fresh drawings. The old ones cannot be altered to fit the new design without interfering with their value as records of the original work, whilst the labour expended in the effort will probably be as great as that required for entirely fresh work. Even then the result will frequently be a disgrace to the draughtsman; it will almost certainly be so when two or three revisions are superadded. It is, however, desirable that a reference to the new drawings should be marked on the face of the old ones, so that a new, inexperienced, or even careless draughtsman may have due warning of the change in design.

When only a portion of the engine or machine is redesigned it will suffice to make a new drawing for that portion. This will really be a sectional, piece, or shop drawing, and must be re-marked accordingly. The better plan appears to be to put on it the same number or symbol as on the original, and to add to it a small letter “*a*” for a first alteration, “*b*” for a second, and so on. Thus, to take our last example, the renumbering or marking of the drawing of an amended pitman, under the two methods of registering drawings, would be:—

by numbers	$\frac{D\ 1342}{S9a}$
by symbols	F.P.L.—9 <i>a</i>

Another way may be adopted when numbers are used, and that is to mark the new drawing with the next shop

drawing number, thus $\frac{D\ 1342}{S\ 27}$, but the addition of the

small letter appears the preferable mode. The original drawing or drawings will have marked on the face of them "Corrected by S 9a" or "Corrected by F.P.L.—9a," as the case may be. A similar remark must be made on the face of the general arrangement drawing, immediately over the portion altered. The new sketch will be marked "in correction of S 9" or "F.P.L.—9." All these notes should be very clearly and neatly made; to ensure distinctness it is well to use carmine colour for the purpose, and to surround them with an oval or other distinctive mark, also in carmine. It will be convenient to keep this distinctive mark unaltered when once it has been selected, but the exact form of it is not of great importance.

Of course, the cross referencing must be carried throughout, both to the altered drawings and the first one, in the event of a second or third correction. All the tracings and prints must be marked in like manner.

Notes of the altered drawings must be made in the register, and for this purpose it is expedient to have a "remarks" column, although for economy of space we have not shown it on the examples previously given. It will probably also tend to clearness to make such notes in red ink, but it must be good red ink, which will not discolour, as so many of them do, with age.

Alteration of Patterns.—When patterns are altered so as to destroy their original purpose, a note of the destructive revision must be made in the register in the same way as with drawings. The labels on the patterns must also bear references in like manner, so that the pattern maker may readily trace the history of the changes made. However, it will probably be found objectionable to alter the original patterns for the majority of standard machines, even when such alteration can be effected without difficulty. The manufacturer has to be prepared to execute repairs and renewals of parts of those already supplied by him, and the demands for such renewals will probably continue for several years after he has placed an improved form on the market. Again, he may receive repeat orders, which his customers may insist shall be identically on the old lines, and though mechanical engineers may properly advocate the value of their improvements, they should remember the truth of the Austrian theory so clearly expounded by Dr. William Smart, of Glasgow University, "That value is determined

by the appreciation and requirements of the consumer, and not by the skill or labour expended in the production of the article." Great, therefore, as is the nuisance of storing obsolete patterns, it must often be endured unless old customers are to be offended and lost.

Drawings for Works.—All this elaboration of registration and record will be undertaken by the draughtsman, not for his own amusement, but to facilitate his work in supplying information to others—that is, to the foreman and workpeople who have to transmute ideas into machines. No drawing office work will, therefore, attain its content unless it assists the execution of that done in the shops.

Preparation of Shop Drawings.—The preparation of working drawings for the shops deserves greater attention and care than are sometimes given to it. The drawings are sometimes hastily sent out in an incomplete form, and the result is loss of workmen's or foremen's time, and frequently explosions of bad temper. This lack of finish and correctness does not generally arise through bad management in the drawing office; it is more frequently caused by the office being inadequately staffed, and the chief draughtsman being compelled to rush his work with such aid as he can get from indifferent and badly-trained assistants. There is commercial danger as well as technical trouble in such management as this, and no wise board, no thoughtful and prudent directors, will permit its continuance.

These shop drawings are to contain all the draughtsman's study of the specifications; all the results of his consultations with the general manager, or with the purchaser and his inspectors; and all the improvements or alterations which may thereby have been effected in former constructions. The draughtsman, who is responsible for the designing, has a perfect right to expect conformity to his designs, but then he must see that they are intelligibly and clearly portrayed; he must remember that the workman is not already in possession of the knowledge he has been laboriously acquiring.

The drawings from which shop tracings are made should be completed in pencil, leaving the inking in to be done when the machine, &c., is finished. This will prevent unsightly erasures through alterations which may compulsorily arise during the progress of the work. But the completion must be actual and not merely approximate;

not only must all the necessary lines and details appear exactly as they would in the finished drawing if then inked in, but all the dimensions must also be inserted. Workmen should never be expected, nor permitted, to work to scale, and the only way to prevent this is to furnish them with *all* the dimensions on the face of the working drawing.

No drawing or tracing must be permitted to leave the office without the progressive number or symbol on it; indeed no drawing should be commenced until this has first been placed on the sheet of paper. Stencil plates are best for this purpose; rubber stamps generally smear and look dirty on such work, though they do well enough for commercial, accountancy, or auditing purposes.

Separate Drawings.—On reference to the symbol register of drawings, F.P.L., it will be noticed that in the column "Piece or Shop Drawing No." a remark is made "With No. 1," or "With No. 6." This means that two or more piece numbers are placed on the same sheet of paper. In general, however, it will conduce to economy of time, both on the part of the workman himself, and of his foreman, if each detail or piece drawing is printed off for the shop on a separate sheet of paper. John Smith has a recurring desire to chat a few minutes with Bill Jones, working perchance a few benches away from him, and if the two men have to take their instructions from the same sheet, he has an ever-ready excuse for his peregrinations.

Examination of Drawings.—Finally, all drawings must be carefully and minutely examined by the chief draughtsman, or a senior and reliable assistant, before they are permitted to pass to the print-room or workshops. Such examination must be certified by the examining officer affixing his initials, in ink, so as to prevent any after evasion of responsibility.

Return of Tracings and Prints.—All tracings and prints must be returned from the shop to the drawing-office, to be filed for future use, after the work has been completed for which they were issued.

Temporary Sketches.—Pen and ink sketches, and even partially completed or outline drawings, have frequently to be made to send to customers with suggestions, or to other manufacturers with orders or enquiries. Again, our readers know, alas too well, the crotchety purchaser who will insist on some trifling alteration from standard design,

too insignificant for a completed drawing, and of too doubtful utility for permanent adoption. In this latter case some sort of drawings must be made for the men to work to, but, generally speaking, very rough sketches will serve the purpose if dimensions are carefully and accurately marked thereon, and the shop drawings, which are modified thereby, accompany them. Of course, if the alterations are extensive, or at all complex, the sketch should be fully completed, so as to avoid the necessity of referring to the original drawing—a necessity which may involve waste of the workman's time. The British machinist is usually a splendid fellow, but he must not be credited with possession of "all the talents"—that would be too great an imposition on his abilities.

All these temporary sketches should be prepared in copying ink. It is better to use the stronger preparations which the railway companies adopt for their Clearing House returns, so that copies may be taken some time afterwards. These sketches should, before leaving the drawing office, be copied in a large sized copying book, provided with a good index. A reference should be placed on each such sketch; they are only of a temporary nature, it is true, but it is desirable to have a ready means of identifying them. When they relate to, or are modifications of, existing contract or standard drawings, the number of such drawing should be placed at the top, or top right-hand corner of the sketch, and underneath it the page of the copying-book preceded by the word "Sketch"; and in the case of those which do not refer to any previous drawings the word "Sketch" and the page of the copy-book only must be used. Thus, for a slight modification of the side-bar of the foot-press, already referred to, the marking will be

F. P. L.—3

Sketch 47 ;

whilst a tracing sent to an inquirer, with a suggestion in reference to a machine or work for which there are no existing drawings (and some such will from time to time crop up), the reference will merely be,

Sketch 48.

The index of the copy book must be kept entered up closely to date, and should be on the dictionary plan, so as to show both the name of the machine, and that of the inquirer or purchaser.

Tracings Sent Away.—It is important that the drawing office staff should exercise sufficient control over sketches and tracings sent away, and a record of them in distinct form will assist in this. It has also been stated that all tracings and prints should be returned from the shops to the drawing office to be filed, when the purpose for which they were issued has been completed. To ensure this being done, the drawing office must keep some register of them, and this registration is better in a distinct book than in the drawing register, although the latter might be modified so as to serve the purpose. The disadvantages of such a method are, however, far greater than any temporary advantage which might be obtained.

For tracings sent to customers, manufacturers, or others of the like kind, a book ruled in the following form should be used.

TRACINGS SENT AWAY.

Date.	To whom sent.	Reference No.	Particulars.	Remarks.

When a print or tracing is sent with a tender, the fact, with particulars for identification, must be noted on the tender form.

When a tracing is sent to another manufacturer with a request for his tender, it must be likewise noted in the letter to him. When it accompanies an order it must be noted on the order form.

When finished drawings are forwarded to a customer in accordance with a clause in the contract the fact should be recorded in the drawing office order book.

But *all* these tracings, prints, or drawings must be entered in the book for tracings sent away, in date order, as they leave the drawing office. The remarks column will serve to record the means by, or purpose for which they are forwarded.

Shop Drawings Diary.—Tracings and prints sent to the works should be entered in a diary, or kind of sundries ledger; those sent to foremen or workmen employed away from the establishment must be also entered in it. The book should be ruled with vertical columns for the following particulars:—

Date sent to shop,
To whom sent,
Number and description of tracing, print, or sketch,
Date when returned.

The blank space in the last column will show what tracings, &c., are out in the works. It will assist in tracing these if each page has a blue lead line ruled across it when the date returned column in it is completed.

Both these books may be of an inexpensive character, as they will seldom entail references of a kind to destroy them; of the two, the latter (shop drawings diary) will probably undergo the greater wear and tear.

Filing Drawings.—It has already been said that all drawings, tracings, and prints must be returned to the drawing office to be filed. By the use of the drawing register the numbers, or symbols, of these drawings can easily be found, even after the lapse of many years, but unless they are systematically put away in their proper places, the drawings themselves will not be found. It is impossible to lay down specific and detailed rules for this filing; much will depend on the character of the work; still more will be regulated by the fittings and accommodation of the office. It is, however, absolutely necessary that any method which may be adopted should be adhered to, and that continued variations of it should be sternly forbidden. All drawings must be filed in their proper receptacles immediately they are finished with; there must be no tossing them into the top of the drawer, or into a sorting drawer, to be properly filed at that "convenient season" which never comes to the untidy or dilatory man. The following suggestions will be found useful:—

All drawings, &c., should be filed in accordance with their progressive numbers; original completed drawings in one drawer or cupboard, and tracings, or prints therefrom, in another. When the symbol form is used, the alphabetical arrangement will take the place of the progressive numbers; the manner of filing will be the same, and there will be no difficulty in working it.

All drawings or tracings should be filed flat; shallow trays fitting in a cupboard, or shallow drawers, will be found most convenient for this purpose. When deep receptacles are used, the drawings are apt to get torn, whilst on unprotected cupboard shelves they soon become damaged by dust.

Each drawer, or tray, should bear a well-defined and distinct label, showing what the contents are. Thus:—

	101	200
or	M.P.A.	T.D.H.

The labels will, of course, be changed when obsolete drawings are removed from these drawers and trays to other receptacles.

When it is deemed desirable to keep a separate drawer or tray for any particular contract, it must be labelled with the name of such contract, thus:—

H.M.S. ACORN; or,
BALTIMORE AND OHIO EXTENSION RAILWAY.

It should, however, be remembered that the registers and index of drawings will enable any of them to be discovered in the general file without difficulty, and the use of a separate file is of doubtful advantage; it is apt to create difficulties and irregularities in filing.

When shop tracings and prints vary much in size it is sometimes desirable to have different receptacles for the various sizes of paper used. When this is done, the outer labels should specify whether the drawers contain large, medium, or small-sized drawings, as the case may be, as these divisions will usually be effected by internal partition-boards.

Standard drawings and other important documents should be carefully protected against the risk of fire. When this can be accomplished by placing them in a strong room adjoining the drawing office it will be the most convenient way, but the feasibility of this will depend on the construction of the offices; in many cases it will not be possible to make any better arrangement than placing the drawings in the general strong room, or in safes in the drawing office. In any case, the method of arranging the drawers and shelves already described should be used in these fireproof receptacles.

No draughtsman must be permitted to remove any drawings or documents from the works, either for purpose of study or any other reason, without the special permission of the general manager.

Each drawing table should be provided with shallow drawers underneath, so that drawings in progress or in use may be placed there at night. A large linen sheet should

also be provided to cover each table, to protect drawings left upon it at night, or during the temporary absence of the draughtsman.

Sketch Books, &c.—Before leaving the drawing office, there are one or two points which may usefully be remembered. And one of these is the necessity of substituting mechanical appliances for human labour, whenever it can be done, not merely on account of the saving of time, but also because of the greater average accuracy thereby obtained. The modern form of slide rule is extremely handy, as it can easily be carried in the waistcoat pocket, and yet comparatively few English engineers use it. It is chiefly left in its older form to the workman and the rule-of-thumb foreman. Yet it is capable of use for an immense variety of purposes, and of saving, in the use, a great number of troublesome calculations. We have seen an American engineer employ it for calculations of simple exchanges, and even for arbitration of exchange, as well as for more strictly engineering details. In some ways our trans-Atlantic cousins are far in advance of us, in adopting the mechanical appliances which the drawing instrument maker now prepares for saving human labour.

Sketch books, again, should always be ruled with sectional lines, and each draughtsman should be provided with one. They should be neatly kept, as untidiness in them is apt to become a habit, which in time extends to finished work, and the registered numbers of the drawings should be marked in them; but, on the other hand, valuable time must not be wasted in pedantic compliance with these rules. The sketch books are merely temporary memoranda, the value of which is largely depreciated when permanent drawings are made. Abbreviations are frequently used in these books, and in other drawing office documents, to indicate the nature of drawings, the material to be used, or the patterns required. It is not very important that these abbreviations should be determined on any exact plan, or according to any scientific rule, but it is extremely desirable that the same should be used throughout the office, and that when once adopted they should not be varied. They will frequently appear on the face of permanent drawings, and for this reason uniformity and continuity of practice is necessary.

CHAPTER XIV.

THE WORKS MANAGER AND HIS DUTIES. DEALINGS WITH WORKPEOPLE.

The Works Manager.—It has already been stated that a copy of each shop order must be sent to the works manager. A little explanation of the title seems necessary, since in some establishments it will be totally unknown, whilst in others it will be separated into three or four divisional titles, such as engine works manager, electrical manager, and shipyard manager. In all cases the duties have to be performed, whatever the man performing them may be called, and much the same characteristics will be essential, whether the general manager does the work, or deposes it to one of the shop foremen. To continue the military simile: just as the drawing office represents the general staff of the firm, the works manager may be compared to the corps commander. He is the chief of the executive departments—the officer who has to carry into actual execution the brain monitions of the mere student; to transform conceptions, designs, and drawings into actual working machines, instinct with motion and power. He must be as truly a scientist as the draughtsman, but of a different type.

Relations with Drawing Office.—It is a frequent complaint, in other forms of business as well as engineering, and even in political circles, according to Mr. Herbert Spencer, that the scientific man and practical man fail to understand, and therefore mutually despise, each other. This should not be. There is a duality in their work, sometimes difficult of reconciliation, but which must be made to serve the prosperity of the firm by mutual consultations and concessions. If the chief draughtsman and works manager are equally well versed in their respective duties, and are intelligent men, devoid of egotistical estimation of their own powers, these consultations will arise naturally, and almost as a matter of routine. If, however,

they do not so arise the general manager must insist upon their institution, even if he has to call a daily levee of the principal officers, and preside over it himself.

Qualifications.—The works manager must have a thoroughly practical acquaintance with all branches of engineering conducted in the establishment, and this necessity renders the appointment of an ordinary foreman, who has risen from the ranks, of doubtful benefit, and sometimes positively hurtful to the firm. Some of the American firms largely attribute their success to the extreme care they have bestowed on adapting the working conditions, speed, and equipment of every machine and tool in the shop to the special work it has to do. Such adaptations as these can, however, only be carried out by a man who is versed in all the varied operations which are carried on; by one who in the truest sense is an engineer, and not merely a highly skilled fitter or turner.

Workmen and Factory Rules.—Nor do his difficulties end with the user of machinery to the best advantage of the firm; this indeed forms but the least of his trials. Subject to the ultimate control of the general manager, a control which, however, should never be lightly or incautiously paraded, the superintendence and discipline of the workmen will devolve upon him. It is easy to compile elaborate rules for regulation of every detail of the men's work; even Government establishments in their most demoralised days did that; the important thing is to see that whatever rules are made shall be strictly enforced, and that they shall not be irritatingly numerous. The law maker must also be the law observer, and impress his regulations on the men quite as much by force of example as by distributing them over the shops' walls.

But whilst the internal regulations of the factory are best expressed in a few concise rules, carefully selected, and draconically enforced, the Factory Act regulations must be exhibited in the actual legal phraseology adopted by Parliament. They must be both sufficiently posted in convenient places, and maintained in good order; no Home Office Inspector will complain of the profusion of them, but he will regard as an unpardonable offence the omission of half a stipulated sentence.

The works manager must also make himself acquainted with local bye-laws, and the extent to which the authorities of the municipalities interfere, or are empowered to

interfere, with the works within the area in which he is then engaged. A method has grown up, during late years, of obtaining special powers under local acts, and the practice of the authorities may in many ways differ in Leeds from that followed in Glasgow. Should a manager, therefore, remove from one town or district to another, he should at once make himself acquainted with any changes in local requirements, and should also ascertain with what activity they are enforced. The inspectors of the progressive Corporation of Beckton-on-Tyne will probably be much more energetic than those employed by the aldermen and councillors of Old Sarum.

Works Managers' Order Book.—Exactly as an order book is essential in the drawing office, to enable the draughtsman to follow out an orderly system of preparing his drawings and arranging his work, so it is desirable that the works manager, in works of moderate size, and most certainly in large ones, should have an order book in his own office. In small establishments, where office cost is an important factor in the profit and loss account, he may be satisfied with access to the drawing office order book, but this course, although it may save something in wages and stationery, is open to many objections. The particulars required by the draughtsman and works manager are different; and in many respects the duties of the one commence where those of the other end.

The book to be used for this purpose may be an ordinary faint lined foolscap one, but it is more convenient when properly ruled in the following or other like form.

The works manager, as well as the foremen concerned, is furnished with a copy of each shop order issued, and from this he can obtain the particulars of the shop drawings required. The blanks in the column for date received will show him what drawings remain, at any date, unissued by the drawing office, and enable him to apply to the chief draughtsman for an explanation of any delay there may be. The patterns required can also be obtained from the same source, and this will give him control over the pattern maker's work.

The right-hand page of the book will, however, be found most useful to the works manager, as it brings before him, in very plain language, the danger of delays which may be caused by the non-delivery in due time of materials on order from other manufacturers. It is not usually

WORKS MANAGER'S ORDER BOOK.

Left-hand page.

Order No..... Date of Order.....189...

Name of Customer.....

Particulars of Order.....

.....

.....

Date of delivery.....189...

SHOP DRAWINGS.

Particulars.	Reference.	Date received.	Particulars.	Reference.	Date received.

PATTERNS REQUIRED.

Particulars.	Reference.	Date completed.	Particulars.	Reference.	Date completed.

Right-hand page.

MATERIALS ON ORDER.

Date ordered.	Order No.	From whom ordered.	Particulars.	Date of delivery required.	Date received.

necessary to enter on this page those materials of a general character which are ordered in bulk by the storekeeper, to be delivered out of stock by him for any and every contract for which they may properly be demanded: such a duplication of the storekeeper's requisitions and general office order book would too frequently be a waste of valuable time. But there are occasions when the prompt delivery of such general stores is of the utmost importance: the order book is an important memorandum of work required to be done, but is not in any sense a permanent book of record; these special and specific requirements of general stores should, therefore, be noted in it, under the head of each order for which they will be required, so that their urgency may be constantly before the works manager, and that he may, through the proper office channels, continually press for their delivery.

Works Manager's Clerk.—The manager's time is too valuable to be wasted in clerical work, or occupied in filling up order, and other office books. It will usually be found more economical, and indeed in works above a very moderate size, it will be absolutely imperative to provide him with a clerk; not necessarily a very accomplished commercial one, but a man who can do minor engineering calculations with accuracy, and make a rough sketch, under instructions, without blundering. This clerk should keep the works manager's order book posted up, and for this purpose should daily visit the general office and obtain particulars of orders sent out; whilst from the foreman and storekeeper he should also secure the dates of receipt by them of drawings and materials. If he be intelligent and willing, he can relieve the manager of much irksome detail work, but he must not be permitted to assume, even by signature, the position of an assistant. Here, as elsewhere, the apotheosis of clerkism must be carefully avoided.

Conferences.—The control of the works manager over the different departments will be materially increased by the arrangement of weekly conferences at which the work in the yard can be discussed with the technical and subordinate officers, who should be present at it. Formerly the large carting companies attached to the railways held such conferences daily, but the conditions of engineering works are so different that a daily meeting would be unnecessarily troublesome; once a week would probably suffice for the

purpose. The chief subject matter for discussion will be the progress of the various orders in hand, and the causes which may be operating to delay them. When the draughtsmen, the foremen, the storekeeper, and the order clerk are all seated round the same table, there will be little opportunity for a game at battledore and shuttlecock with shuffling excuses, the unsatisfactory result of which is that no one is to blame for the dilatory progress, and that no one is responsible for work being behind time. The orders in hand should be taken by the works manager in regular sequence, and each investigated independently; the inquiry should be so thorough as to expose completely any neglect or avoidable delay.

These conferences will also form a convenient medium for discussing the new orders received. It is imperative that ways and means should be considered at the earliest possible moment, and that the various officers who will be engaged on the work should thoroughly understand each other, and the time which each department will require for its portion of the work. The danger of departments waiting for, or being delayed by, others is thus reduced to a minimum: five minutes round a table will clear away more difficulties than a host of memorandums, indispensable as the latter are for communicating facts or figures for record, or for the men to work to.

Shop Appointments.—The procedure adopted by different firms and companies for the appointment and promotion of the staff varies with the peculiar circumstances of each; nor is this surprising when it is remembered that modern engineering enterprises include such diverse forms as private firms, single-man companies, private limited companies, syndicates, and public limited companies. In all such enterprises, however, the works manager will usually be consulted with respect to the engagement, pay, promotion, and dismissal of the workpeople and petty officials. Indeed, it is sometimes contended that he should have uncontrolled power to appoint and dismiss all such men, as otherwise he cannot be held responsible for any adverse state of affairs which he is not only powerless to prevent, but possibly had actually predicted and protested against. Such a contention, however, opens the door to grave evils, and frequently accentuates the difficulty of dealing with the trade unions, which, under any circumstances, is

sufficiently great. What is really required is, that no change in the working staff, no promotions, no advances of or reductions in wages, no alterations of classification shall be put into force without the works manager being consulted, and his opinions being duly considered. He is in more immediate contact with the subordinate officers and men than either the directors or general manager; to neglect or refuse to listen to him would, therefore, be to close one of the most valuable avenues to knowledge of the staff.

To discharge this portion of his duties with satisfaction to his employers and credit to himself, it is essential that the works manager, equally with the general manager, should be endowed with a "capacity for justice." It is a capacity which can be largely cultivated.

The foremen over the different departments are in their several spheres miniature works managers, and will frequently be consulted by him, and by the general manager, on points connected with the staff. They should, therefore, like their superiors, be actuated by the truest *esprit de corps*, and a desire to render to every man that recompense which his conduct deserves.

Workmen's Characters. — In two ways the works manager is called upon to report on the conduct of the men under him; first, in advising the directors and general manager on promotions, changes, or dismissals to be made; secondly, in the replies which he makes, or supplies information for, to other firms who send enquiries respecting workmen who have left. It is, however, difficult for him to remember the character of every workman about the place, especially when large numbers are employed, and frequent changes are made; and without a very distinct memory of the man it is unsafe to give an applicant a character. Recent social movements, which it would be extremely foolish to ignore, favour the workman in every possible way at the expense of the employer, and an adverse report on a man who has left will probably have to be proved "up to the hilt" if the writer and the company are to escape any penalty for it. Great caution must be exercised both in giving characters and in concealing from prying eyes those which may be received. The documents are given in confidence by the former employer, and ordinary business rectitude would demand that they should be preserved inviolate.

When a workman seeks employment an application should be made to his former employer for his character. Such applications may be made by means of a printed form, with the questions on the flyleaf, and space for the answers to be inserted. These questions should ask the period for which he was employed, and in what capacity, his ability as a workman, and his conduct as regards honesty, industry, and sobriety. Until a satisfactory reply has been received he should only be temporarily employed as from day to day; when it arrives an intimation should be given to the foreman and timekeeper that the man can be regarded as regularly employed.

This character will be the foundation for another to be given to the man when he leaves, modified, of course, by his conduct in the interim. It should therefore be entered in a workmen's staff or record book, and afterwards safely placed under lock and key. The staff book must also be kept in a locked drawer, or safe, so as to be guarded from improper or curious inspection. It should be cut in index form, to facilitate reference, and ruled with columns in which to insert the following particulars:

Date of engagement.

Name of last employer.

Character from last employer. It will be sufficient to insert in this column its general purport, such as "satisfactory," "indifferent," "bad time keeper," &c.

The full name and address of the workman; the address must be corrected whenever he changes his residence.

The trade on which he is engaged, and rate of wages.

Dates and variations of wages.

Date and cause of leaving.

Abilities as a workman, and character for honesty, sobriety, and industry.

Sufficient room must be left between each of the names to permit of proper record of the variations in wages, and it is better to ensure this by dividing the book by horizontal red ink lines into definite spaces, one of which must be apportioned to each workman. It is advisable also to keep a separate book for the apprentices, and to remove the

names into the workmen's book as the several periods of apprenticeship expire.

The Ceres card system may be substituted for an index book, a separate card being used for each workman. It will be found very convenient for this purpose if properly printed cards are employed.

Attainment of Character.—The efforts of every person connected with a manufacturing or other producing establishment must be constantly directed to the development of character in the employés; not necessarily by moral injunctions, nor even by any apparent efforts, but by constant study to fit the general tone of the establishment to the improvement of the workpeople. The three essentials of character to which we have already referred are honesty, sobriety, and industry. Honesty is fortunately characteristic of most Britons; it is not confined to any one class, and may be expected in the workman as fully as in the peer. Any departure from it will necessarily entail sharp punishment, if not indeed dismissal. Sobriety, again, is much more general in these days than it was formerly, and it is only in exceptional cases that there will be any cause for complaint of intemperance. But the third essential of character, industry, is much more a development, a growth, an evolution, than inherent in the individual, and it is desirable not only to remove impediments to its cultivation, but also to constantly afford encouragement to it.

Incentives to Productive Energy.—One of the most difficult problems in the commercial management of factories is the institution of some plan whereby the productive powers of the workmen may be stimulated to the utmost limit. This problem is becoming increasingly difficult in consequence of the frequent amalgamations of large works now so prevalent, and the large bodies of men thereby brought under one management. In the olden days of cottage and village industries, and in the succeeding times of small workshops, the master worked alongside his men, or from a point of vantage in the room supervised their industry throughout the day. There was no shirking, for the master's eye was roaming everywhere, and no man could escape detection of his neglect. The factory system has altered all this, in many ways for the better, but in some for the worse. The division of labour, more particularly in the largest establishments, tends to make both master and men specialists in their respective branches; far

more expert than those of a generation back in their own particular work, but less capable than their predecessors of transferring themselves from one class of work to another. We include employers in this indictment, for it too frequently happens that the clever and cultured engineer, who can grapple with the most abstruse questions presented by his professional duties, is ignorant as a child of financial matters, of cycles of supply and demand, of the influence of currency on trade, for good or evil, and of the ultimate effect which government measures may produce on the commerce of the country. Nor is it possible, even with the best intentions, for the master to watch details with the same lynx eyes the former working employer did, or scrutinise his accounts, scattered through a dozen books of much complexity, with the same ease the olden blacksmith read off his hieroglyphical lists of debtors and creditors on his smithy door.

The modern factory system demands a different method to the old-fashioned watchfulness of the one man, and requires an incentive which appeals to men's natural cupidity, and converts each workman into his own task-master. Whatever difficulties may have hitherto attended co-operative production, and they are probably inherent and inseparable from democratic co-operation, the movement has this element of truth in it; it affords to the workmen, both individually and collectively, encouragement to employ in their work their utmost industry and ability.

Profit Sharing.—The English endeavour to solve the difficulty has, apart from some partial attempts at co-operative production, taken the form of profit sharing. The best and most successful example is that introduced at the South Metropolitan Gas Company's Works, by the managing director, Mr. Livesey. So far as can be judged from the length of time it has been in operation, and from the testimony of Mr. Livesey himself, it has induced the men to work more vigorously, and rendered them more contented with their employment than did the old system of fixed wages without any bonus dependent on the profits. It is, however, a question whether this system is an ideal one for engineering works of mixed character, or indeed whether it can be applied there with equal justice to all the hands unless a very complicated system of accounts is instituted. The profits of a firm arise from the

aggregate of its transactions, but it is easy to imagine that, whilst a profit may be made over the whole of its transactions, this may be exceptionally heavy in some departments, and very small, if indeed a loss is not incurred, in others. To pay all the men an equal percentage on their wages would be to perpetuate the baleful endeavour made by some trade unions to carry the indifferent or unsuccessful workmen on the shoulders of the more skilful men. The success which, however, has followed its introduction into the Gas Company's works, and also in a lesser degree into other manufactories, recommends it to the consideration of engineers: if it has not yet arrived at perfection of treatment, it may possibly be modified so as to remove some of its present defects, and adopt it to the requirements of an engineering factory in the absence of an alternative and better plan.

American Methods.—Our American cousins have made more strenuous efforts to solve the problem than any we have attempted, and they claim in different directions to have been successful. In the year 1896, C. R. Richards, in the *Pratt Institute Monthly*, gave an interesting account of the industrial organisation in the works of the National Cash Register Company, of Dayton, Ohio. The first step in the "new factory system" of that firm was the replacement of the superintendent by a committee of five heads of departments, upon whom the responsibility of management was placed, and this was shortly supplemented by sub-committees of foremen and sub-foremen, who were entrusted with the largest possible amount of responsibility and initiative. The employees are encouraged, by a generous system of rewards, to offer suggestions for improvements in design or manufacture, whilst "the payment of high wages is also an integral part of this system of individual incentive; for the company have found that nearly all workmen increase their daily output when sure of an increased return." Mr. Richards claims entire success for this system, which appears to be a modified form of co-operation, with the shareholders in the position of bankers or mortgagees; but he also indicates several factors which diminish the possibility of its general adaptability. In the first place, a large number of the hands are women, and it is well known that women will accept lower wages, and are content with a lesser standard of comfort than men workers; the complaint made against

them by most employers is that they are too easily satisfied with their present living, that they have less ambition to rise from their initial or normal position than men have, and will not so patiently and consistently strive for that end. A large proportion of women to men in a factory, where the manufacture is of a routine character, will undoubtedly modify, to a large extent, the tendency to labour disputes; and this appears to be the position of the National Cash Register Company. The manufacture of their goods had become so perfected, their workpeople so thoroughly trained and skilful, that the factory had arrived at a condition analogous to that termed by economists "the stationary state." The very success which they attained before adopting their new factory system renders it of doubtful expediency in a more competitive and struggling concern.

Fixed Piecework Rates.—If this were the only contribution made by the Americans to the question of economy of labour, it would interest the co-operator or the speculative philosopher more than the practical engineer; but they have too ardently endeavoured to reduce cost of production to rest content with a result which, though it may prove serviceable under certain limited conditions, cannot be generally adopted. The *Engineering Magazine* of New York, Vol. XII. (1897), contains papers giving six examples of successful shop management, wherein the influence of fair and just dealing, of isolation and environment, and of careful detailed supervision and definite contracts, upon the prosperity of the factories and the contentment of the workpeople are cleverly traced. The success is, however, in most cases, that of isolated works under the dominance of exceptionally skilful managers, who impress their own rectitude and personality on the establishment, rather than of any system which recommends itself for general adoption. One paper, however (Vol. XII., page 831), contains some pregnant remarks on the increase of output through the stimulus of unfettered piecework rates, and is deserving of the most grave consideration by English managers and workmen. It is entitled "Pre-eminent Success of the Differential Piece-rate System." The justice and economy of piecework, even under fixed and absolute rates, is admirably expressed: "Not only does the fast man do more work, but that work is done at a reduced fixed-charges cost, and

the intelligent manager discovers that he must greatly increase the pay of the speedy man or decrease the pay of the slow man to make each equally profitable. Under these conditions the piece-rate at once suggests itself as a remedy. The piece-rate stimulates the slow artisan, and justly rewards the quick worker, tends to increase the area output, and lessen the fixed-charges drawback on profits." In two of the shops taken as examples, that is, in the Baldwin Locomotive Works, and the widely-known establishment of Messrs. William Sellers and Co., piecework rates are seldom altered, unless some general reduction has been accepted throughout the country, or a manifestly improved process of manufacture has been adopted. Indeed, in the Baldwin Works some rates have remained unchanged for the past twenty years, and a workman is there more highly esteemed when he can, by his own exertions and ability, increase his weekly earnings. He has an absolute incentive to increase his output as much as he possibly can, because he knows that he will not, by increasing his own income, lead to cutting piece-work rates, and so be forced to make still further exertions in order to maintain the same weekly wage. There is a case mentioned where, under the encouraging influence of an *unchanging* piece-work rate, twenty-two men eventually turned out more work than forty-four men had originally done, thus increasing their own earnings, and at the same time reducing the ratio of establishment charges to direct wages.

Analytical Piece-work Rates. — But American engineers have applied system and scientific observation to the determination of these piece-work rates, and do not leave them to rule-of-thumb determination. The Sellers' shops produce a large variety of machine tools, as well as specially designed work, and the Baldwin shops turn out many varied descriptions of locomotives, each variety having an immense number of parts; yet in both places we find piece-work sub-division carried out to a much greater extent than in England; as, for instance, in the case of a common nut, where nut-tapping, nut-facing, and the finishing of nut sides are each a separate step in the manufacture, with a piece-work rate of its own. The way in which this is determined so as to afford equal justice to both employer and employed is by the analytical or elementary method, of which the accompanying is an example for planing a surface on a piece of cast iron.

WORK DONE BY MAN.

	Minutes.
Time to lift work from floor to planer table
„ level and set work on table.....
„ put on stops and bolts.....
„ remove „ „
„ „ piece to floor
„ clean machine

WORK DONE BY MACHINE.

Time to rough cut $\frac{1}{4}$ in. deep surface, 4 ft. long 2 $\frac{1}{2}$ in. wide. ....	.....
„ rough cut $\frac{1}{8}$ in. deep, 3 ft. long, 12 in. wide .....	.....
„ finish cut 4 ft. long, 2 $\frac{1}{2}$ in. wide .....	.....
„ finish cut 3 ft. long, 12 in. wide .....	.....
Total.....	.....

Add — per cent for unavoidable delays.

It will be seen that such an analysis as this can only be of value when carefully and conscientiously worked out. It demands exact observation of the time occupied by a good, but not exceptional, workman on any particular piece of work. But more than this, it requires exact knowledge of the capacity of any tool with which he may be working, not merely as employed in an ordinary easy-going workshop, but as used in a progressive and scientific one, where the conditions under which it will work most effectively and economically will be accurately determined. At the Midvale Steel Works the investigations of the piece-work rate fixing department revealed the fact that none of the lathes, planers, boring machines, &c., which were of standard patterns, and supplied by the best makers, were designed and speeded so as to cut steel to the best advantage. The company, therefore, demanded variations from standard designs in almost every machine they subsequently purchased, and in many cases specially designed the machines they required for their own purposes. Thus an investigation, originally intended merely to arrive at a scientific basis for payment of workmen, eventually

resulted in improvements in machines, or in methods of using them. There can hardly be a more forcible illustration of Mr. W. H. Mallock's theory, that the production of modern wealth is the result of ability and not of un-directed labour.

Differential Piece-work Rates.—We have here an example of the assiduous care exercised by American engineers in determining the cost of work in their factories, and ascertaining the best methods of reducing it. They have long recognised that the most efficient way of reducing percentage of cost is to increase the ratio of output to the labour employed. The indirect charges, such as rent, taxes, insurance, depreciation, interest, salaries, office expenses, and cost of power, are seldom curtailed when trade is slack, or when the amount of work turned out is below the average; nor are they materially increased when the factory is doing its productive best. It, therefore, becomes more important to stimulate the workpeople to work their best, and maintain the highest possible speed of production, even by the payment of high wages, than to effect a saving in the wages bill. The system of "differential piece-work rates" was first applied to a part of the work in the machine shop of the Midvale Steel Company, in 1884. So successful was it in the immediate results it produced that it was rapidly extended throughout the works, with the mutual approval of both employers and employed; and it has been continued up to the present date. Indeed, the secretary of the company writes, under date of December 28th, 1897, "Under no circumstances whatever would we go back to the system prevailing prior to its adoption. The merit of the system is so self-evident that there is nothing that we might say about it would increase its value."

The system consists in paying a higher price per unit of work if it is completed in the shortest possible time, and without imperfections, than if it takes a longer time, or is imperfectly done. It is admirably illustrated by Mr. Frederick W. Taylor, to whom must be credited its introduction and development at the Midvale Works. In an article in *Cassier's Magazine* for February, 1898, he says: "Suppose 20 units or pieces to be the largest amount of work of a certain kind that can be done in a day. Under the differential rate system, if a workman finishes 20 pieces per day, and all of these pieces are perfect, he receives, say,

7d. per piece, making his pay for the day $7 \times 20 = 11\text{s. } 8\text{d.}$ If, however, he works too slowly and turns out, say, only 19 pieces, then, instead of receiving 7d. per piece, he gets only 6d. per piece, making his pay for the day $6 \times 19 = 9\text{s. } 6\text{d.}$ instead of 11s. 8d. per day. If he succeeds in finishing 20 pieces, some of which are imperfect, then he should receive a still lower rate per day, say 5d. or $2\frac{1}{2}\text{d.}$ per piece, according to circumstances, making his pay for the day about 8s. or only 4s. instead of 11s. 8d. It will be observed that this style of piecework is directly the opposite of the ordinary plan."

Effects of Automatic Grading of Men.—The advantage of piecework in stimulating production is known to most English engineers, even under the adverse conditions which affect and limit it in this country. It is only just that the good and industrious workmen should receive for his efficiency the best reward the work will allow; it is equally as just that the inefficient or lazy man should suffer for his want of skill or industry. The method of grading or classifying men according to their ability has been tried, and always created dissatisfaction; it is opposed to both the ethics and methods of the unions, and invariably creates suspicion of favouritism. The differential rate, however, classifies the men automatically, and on their work tickets they themselves fix their position in the labour market. If they are skilful and active, they are rewarded for the saving they effect in establishment charges; if dilatory, they mulct themselves for the loss they cause to their employers.

Quick Returns Essential.—Mr. Taylor very pertinently remarks that the workman should be encouraged by immediate knowledge of the result of his exertions; and that, whenever it is possible, he should each day know what progress he has made during the previous day. This necessitates rapid inspection of the work, and immediate returns; but the necessity entails a further advantage, as the office men, who too often are procrastinating in their methods of working, are thereby compelled to keep up their daily tale of work.

Piecework Prices not Cost Accounts.—It may almost appear superfluous to warn our readers that the fixing of piecework prices, either on the analytical system alone, or on the analytical and differential system combined, is not analogous to the keeping of cost accounts. In the one

case it is an estimate of the wages cost of production, just as in a more complex way an estimate is for a tender; in the other it is a record from dissected wages sheets, stores accounts, and cash book, of the amount which has been spent on the production. The former account admits of, and sometimes requires, a certain element of supposition, which should be rigidly excluded from the latter.

Contract System.—The method of sub-contracting, which is in vogue in some English works, is still to be found in many of the New England, and was only dropped by the Singer Company in 1883, after it had been in force for 15 years. That company found that the substitution of piece-work mechanics, with foremen at fixed rates of wages, tended to reduce cost of production below that obtained under the contract system.

The great object of the works manager should, however, be to study all methods of encouraging the men to increased exertion, and maintaining their desire to secure a large output, and to adopt such of them as appear most suitable to the particular factory at which he is employed. There is no absolute design for all bridges, under all conditions; nor is there any unalterable and sole method by which the workman can be induced to part with his best labour.

CHAPTER XV.

TIMEKEEPING. WAGES ACCOUNTS AND RETURNS. PAYMENT OF WAGES. ISSUE OF MATERIALS. COLLECTION OF MATERIALS. STORES BOOKS AND RETURNS.

Timekeeping.—Whatever inducements are held out to the men to increase the output, whatever assistance may be rendered them by the supply of new or improved machinery to attain that end, it is imperative that precautions should be taken against their being paid for time they do not work, or for services which they do not render. In common with most other factories, the workmen of an engineering establishment are admitted through the gate-keeper's office, or past his window, and the system of metal discs or tickets now so generally adopted affords an excellent check on the total time worked by each man. More than this is necessary, it is true, for the compilation of detailed cost accounts, but this check on the time, which will be contributed to by the men themselves, should never be neglected.

Time of Staff and Foremen.—It is essential that the office and managerial staff should keep good time, both for that force of example already insisted on, and for the avoidance of delay in the workshops whilst the men are waiting their instructions. They cannot, however, without loss of authority, be treated in the same manner as ordinary workmen, and required to take up or deposit a ticket each time they go in or out, and some other means must be adopted for giving the general manager sufficient control over their arrival and departure. Probably the most convenient and effective plan is the attendance book, which may be ruled in the following form :—

Signature.	Arrive.	Depart. Break- fast.	Arrive.	Depart. Dinner.	Arrive.	Depart. Night.

All the officers, excepting the secretary and general manager, should be required to enter their arrival and departure in this book, a separate space (which may be divided off by a red ink line) being taken for each day, and the names appearing consecutively according to time of arrival in the morning.

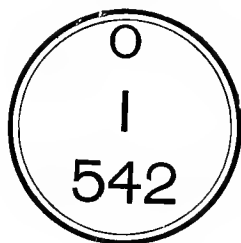
The book may be kept at the gate, but this is only convenient in small establishments, and where the gatehouse is so arranged that foremen and clerks using the book shall not block the way for the workpeople. Where the officers are numerous it is probably better to keep it in one of the general offices, and in some cases to have two or more books, so that foremen and draughtsmen can be signing that kept for their use, whilst the clerks are using the other. Details like these are modified by the numbers employed.

Even when it is kept in the gatehouse, there should be no imperative rule requiring signature in the presence of the gatekeeper. In the first place such a regulation would interfere with his watching the workman take up and deposit their tickets: in the second, it would give him an appearance of authority over those who are really his superiors, and possibly induce him to make impertinent remarks to them. The class of men from whom gatekeepers are usually selected is not one to be entrusted with any semblance of authority over technical officers or competent clerks. But there is a further, and even greater, objection to converting the gatekeepers into a spy over them: these technical officers and clerks have to discharge duties which it is very difficult to reduce to units of time, as the work of a machine, or the workman attending it can be; they have to be trusted, to a very large extent, to perform their work in the best and most conscientious way they can for the benefit of the firm, and it is better to inculcate a high sense of honour in all their dealings, than to set a man to watch part of them. Of course any attempt at fraudulent entry should be reported, by whomsoever it may be detected, but the general regulations of the firm should be such as promote the feeling *noblesse oblige*.

Admission of Workpeople.—No such delicacy must, however, be exhibited with the workpeople, who, under modern conditions of employment and trade unionism, are usually devoid of any strong devotion to their masters,

and unfortunately include many black sheep in their ranks. At the appointed time the gates must be closed and no one admitted until the next appointed time of opening for workpeople. Of course, if a body of men are passing into the yard at the moment the clock is striking, the gate must not be closed in the face of those who are then outside it, and only waiting their turn to pass in. This would be outrageous and demoralising tyranny. A system of fines may be arranged for late arrivals, but it is very difficult to maintain against modern union objections and the emotional sympathies of government officials for working men. Fines seldom attain the end for which they are instituted, and it is probably better to shut out the late arrivals until the next time of opening the gates for workmen's admissions. If this method is adopted it may be modified by admissions at half time, so that the men be not mulct of the whole of one division of the day, but this modification is a matter for the determination of each firm according to its own special circumstances.

Time Checks.—Automatic time-checking machines are generally distrusted by the men, and cannot be regulated so as to prevent injustice to those who, although actually on the premises before the stroke of the clock, are prevented approaching the time machine by pressure of others in front who are at the moment passing it. Probably there is nothing better than the old-fashioned method of time checks, but some recent improvements in the ways of working them add considerably to their usefulness. The checks should be made in four different shapes, for the different portions of the day, instead of uniformly round, and should be stamped with the numbers 1, 2, 3, 4, as the case may be, as well as with the workman's number. Thus



No. 1 will be for the time before breakfast; No. 2 for after breakfast; No. 3 for after dinner; and No. 4 for overtime.

When night shifts are worked, it is better to employ a distinct series of checks for them, and these may either be of separate shapes, or the same shapes as the day shifts, with the letter N stamped on the check in front of the

divisional time number, as **N 1**
542.

The checks must be placed on boards, in number order, and these boards must be conveniently disposed at the entrance to the yard. When large numbers are employed it will sometimes be better to have two or more entrance gates, but the advisability of this will depend on the general arrangement of the yard, and the situation of the buildings within it. It is not generally approved in H.M. dockyards. But where additional entrance gates cannot be provided, it is frequently possible to arrange separate entrance passages, so that the men from 1 to 200 can go through the one, and those from 201 to 400 through another, and so on, the checkboards being placed so as to be convenient for each passage. This will prevent delay in entering the yard and commencing work.

Care should be taken, in stamping the tickets, to provide for a sufficient number of workmen of each degree. The men of each class should be numbered together, joiners, platers, riveters, machine-men, fitters, labourers, etc., so that their numbers may fall consecutively into the proper portion of the pay sheet. To ensure this it is necessary to adopt the system of "gapping," already referred to when dealing with the register of drawings.

Check Boxes.—Four check boxes (or four sets where more than one entrance passage is used) must be provided, and placed in a convenient position near to, but beyond, the check board. As the workman enters he will remove his check from the board, pass forward a few steps, and deposit it in the box. These boxes, like the checks, will be exchanged for each portion of the day or night, and it will be found convenient, although it is not essential, to have the shape of the ticket painted in white on the front of the box. The boxes must be locked before use, and have a slit in the top of each through which the tickets may be dropped.

Immediately the gates are closed for admission of workmen the gatekeeper must remove the boxes from their place, and put them in a convenient spot for the time-

keeper. As soon as can conveniently be arranged after each time of closing, the timekeeper must take the boxes to his office, and enter the time of the men in his rough time book from the tickets he finds in them.

Rough Time Book.—The rough time book may be of a very cheap order. It will not be required for reference after the week or other period for which it is kept, and if the paper will stand writing at all it is quite sufficient. It should be ruled with columns for the different days of the week.

The time must be entered in this book for each division of the day. There are various methods of doing this, but marks of some kind in lieu of figures will be found convenient. Thus the day will be divided into three working portions, in which the number of hours may vary at different periods of the year, but the exact duration of which will always be known to the timekeeper. Three strokes may be used—the first, for the time before breakfast, sloping from right to left; that from breakfast to dinner time from left to right; and a horizontal stroke being employed for the afternoon. A completed day will then be represented ✕. Or the three strokes may slope the same way if found more convenient, ///, but this often tends to confusion. An absolute rule cannot be laid down, and the use had better be left to the timekeeper's discretion.

Overtime should be entered separately in the book (it can be underlined below the man's name if the space is sufficient) by hours, and not by divisions of time. The working of overtime is often irregular, and the time the men are kept at it is not defined with the same certainty and exactitude as the ordinary hours of employment.

No man must leave the works before the ordinary hours without a pass-out slip signed by his foreman. These slips must be handed to the gatekeeper, and by him passed to the timekeeper, who will give effect to them in his accounts.

The rough time book will thus contain a complete statement of the time worked by each man, and if ordinary care is exercised in collecting and recording the tickets it should be an accurate statement. By this book the time keeper can check the wages book, which will be compiled by him from information supplied by the men themselves.

Time Tickets.—For cost accounts it is needful to know the description of work upon which a man is employed, as well as the number of hours he makes during the day; indeed, some such information is requisite for the compilation of accurate departmental and contract accounts, even when detailed cost accounts are not kept. Hence the necessity for the workmen's time tickets usually employed in engineering establishments.

Each workman has a number given him when he enters the service. This will be the number of the time check which he takes from the board and places in the check boxes each time he enters the yard. He must also be furnished with a board for his time tickets, and the same number will be painted on this board.

The boards should be planed smooth, and the top portion only painted. They should be about 6 in. long by 3 in. broad, and rounded at the top, and at the two bottom corners. Six strips of paper 5 in. by 3 in. should be gummed to the board, one for each day in the week, on which the man has to insert the time he is engaged on each job: on the time so entered, unless it is in excess of that shown by the checks, he will be paid; any time he omits should not be paid for without sufficient inquiry and explanation, and the enforcement of this rule will usually be sufficient to ensure care in filling up the papers. Some firms use only boards chalked over, and the men write their time on these and exchange them daily. This will suffice where division of costs is not carried to any minute nicety, but is unsuited to a firm which requires great detail; the men cannot be expected to always know the exact border line between one portion of a job and another.

The course to be pursued then is this: The foreman is starting a man at work on the table of a milling machine, size B, the symbol reference for which will be (if symbols are used) M.M. B — 4: the order number, which appears on the shop order is 5746. The foreman takes the man's time ticket and writes on it
$$\frac{5746}{\text{M.M.B.} - 4},$$
 and this is an authority to the man both to proceed with the work, and to charge it to the special portion of the contract indicated—that is, to No. 4 portion of a milling machine B, being constructed for order 5746. The same course must be followed each time the man's job is changed.

At the end of the day the workman will remove from

his board his ticket for that day, and place it in a letter box, or other suitable receptacle, which should be provided for each shop, except on the last day of the week, when he will deposit there both the board and last slip, receiving a new board the following work morning for the ensuing week. A girl or girls should be employed in the time office to renew the slips weekly, and for this purpose two sets of boards must be used.

When the workman removes his ticket for the day he must write the reference on the next day's sheet if he continues work on the same job. He must also mark each ticket with the date to which it refers.

Wages Book.—The timekeeper has now two sources of information before him, which, if they are correctly dealt with by the men, should agree. He has the time checks deposited on entrance to the yard (modified, of course, by the pass-out slips, in the few cases where these are given), which furnishes the total time worked, and the time tickets, which give the details of each man's work. From the latter the wages book is compiled, but only after they have been compared with the rough time book, and any discrepancies investigated and corrected.

The wages should be prepared by departments. The men's names should be entered in numerical order, to agree with the numbers given them on entering the yard, and which numbers, it will be remembered, are "gapped" between different trades. Spaces must be left in like manner in the wages book, but they need not be so great as in the numbers. The latter must be sufficient for an increase to the very fullest capacity of the works to employ men of any trade, even during the most pressing emergency; the former need only provide for the additional men expected to be engaged during the week, or, if the book is ruled for a month, during the ensuing four weeks.

In order to provide for the payment of the men, and also for details of the various jobs upon which they are engaged, two cash columns are desirable. Many forms are in use at various works, for pay or time books, but the following will probably be found convenient for the purpose. It has the advantage of having been practically tried in an engineering establishment, and found to answer.

In the column headed "process" the numbers 5746, 5616, and 5730 are the order numbers, the machines on which these workmen are employed being already ordered

WAGES BOOK.

No.	Name.	Process.	Time.						Total Time.	Rate.	Wages per Process.			Total Wages per Man.			
			Monday.	Tuesday.	Wednesday.	Thursday.	Friday.	Saturday.			1	16	0	1	16	0	
151	Thomss Jones...	5746 Table ...	1	1	1	1	1	1	6	6/-	1	16	0	1	16	0	
152	Edward Lloyd...	5746 Table ...	1	1	...	...	...	...	2	6/-	0	12	0			
		5746 Frame...	1	1	1	1	4	6/-	1	4	0		1	16	0
153	Edward Evans..	5746 Frame...	1	1	1	1	1	1	6	4/-	1	4	0	1	4	0	
154	Samuel Davies...	{ 5616 Bed plate }	1	1 1/2	...	...	...	...	1 1/2	5/6	0	8	3			
		5746 Frame ...	...	1 1/2	1	...	...	...	1 1/2	5/6	0	8	3			
		5730 Table ...	...	...	...	1	1	1	3	5/6	0	16	6	1	13	0

by customers of the firm. The words table, frame, or bed-plate indicate the special detail of the machine on which work is being done by them. Under the symbol system the order number would be used, but the symbol of the part would be used as given in the shop orders, and by the foreman to the workman on his ticket. Thus order 5746 is for a milling machine, size B; and the entry on the time ticket and in the wages book for Thomas Jones' time will be,

5746 M.M.B.—4.

Work done for the firm itself, and which, of course, does not bear any order number, must be set out in such manner as to distinguish its character, and the particular building or other structure or machine on which it is done. Thus:—

“*Buildings*.—Repairs of smithy roof.”

“*Repairs of machinery*.—Countershafting in machine shop.”

“*New machinery*.—Headstock of 12 in. screw cutting lathe.”

“*Expenses*.—Assisting storekeeper.”

Where the symbol system is in use, and a symbol is available, it must be used instead of a description in words, thus:—

“New machinery.—S.L.D.—5.”

The example given provides only for one week, but the book may be ruled for four or five weeks. In this case the first two columns need not be repeated, but those from process inclusive, to total wages per man, must be ruled for each week.

Abstract of Wages.—An abstract of the wages book will be required, both for the ordinary commercial books of the firm, and for the cost accounts. It will generally be found convenient to make a separate total in the wages book for each department therein, and at the end a summary of the whole of the departments, the total of which summary will agree with the wages paid for the week by the cashier.

The abstract is most conveniently prepared on large sheets of paper ruled with perpendicular red lines, in manner following:—

and none against attempted fraud; there are, therefore, certain requirements which should not be overlooked or neglected.

Piece Work.—It is necessary that a careful check be kept over piece-work payments. The rates will be fixed by the works manager, or by a department under his immediate direction if the analytical piece-work system is adopted. The necessity for continuity of piece-work rates has already been referred to; the best work will never be obtained from any set of men who feel that increased diligence, or greater intelligence will tend to impose upon them heavier burdens in order to maintain their weekly wage. They must, when fixed, be recorded in a rate book, available for reference by the officers who require access to them for the due discharge of their duties.

Where piece-work practically takes the form of sub-contracts, as it occasionally does in shipyards on cargo steamers, or caisson work, an account may be opened in the ledger with the sub-contractor. In this account he will be debited with the various weekly payments on account, the entries being:—

Thomas Ford (plating contractor).....	Dr.
Wages Account	Cr.

When the contract is completed this ledger account will be credited with the amount thereof, less any deductions for incomplete or inferior work, and finally debited with the amount paid him through either the cash book or wages to balance the account. The weekly “subs.” will be passed through the wages book in the usual way—the abstract heading being, however, “Thomas Ford,” and not the order number and designation of the portion of the ship or other construction. The cost accountant will obtain the particulars for his records from the commercial journal, exactly in the same way as he has to procure other like information from the cash book.

In general, however, it will not be necessary to open ledger accounts with the man—certainly not with individual men who do not employ others to assist them. Thus a unit of work is given to Evan Jones at the piece-work price of £6 5s. 8d. He draws £2 for each of the first two weeks, and completes the work by the end of the third: his wages for that week will be £2 5s. 8d., and the respective entries will be as indicated in the table following.

It will certainly facilitate his work if the clerk who makes the extensions keeps a rough memorandum book of each piece work job which extends for a larger period than the week; and when the greater portion of the work of the establishment is conducted on the piece-work system, such a book is absolutely necessary. In the latter case it may be of larger size, and provided with an index for the men's names.

Checking Rates.—The rates of pay must be checked weekly, both to detect clerical errors and prevent fraud. So far as piece work is concerned, the piece-work rate book must be referred to, both for the final payment and also for the weekly "sub." sanctioned by the works manager. If this has not been inserted in the rate book, then he must be applied to for instructions before any amount is entered for payment. It will probably be better to obtain his initials to each piece-work rate, and payment on account, when only a small portion of the men are so paid: when piece work is the general rule of the shop it may be found inconvenient to require this, but his signature should be obtained at the end, and must be understood to certify that he has satisfied himself of the careful examination of the wages and piece-work rates, and has determined any doubtful points.

The ordinary day rates must be compared and checked from the previous week's wages list. If any new men appear, or any alterations are made in rates, they must be confirmed by reference to the workmen's staff or record book, and the works manager should, as an additional precaution, initial all such variations.

The wages book should always be looked through, and signed by the works manager at the end, to certify that he is satisfied with its general correctness. It should also be examined by the accountant, before the wages are paid, to ascertain that the routine of comparison and signature has been complied with.

Checking Time.—The checking of time worked is more difficult, particularly in the event of any collusion between the timekeeper and the workpeople. It is almost impossible to set a clerk belonging to the accountant's department to check the time every day: this in effect would be making him into an additional timekeeper. But a trustworthy and smart clerk may at irregular times, and without any prior notice, be sent into the time office to

check, in every particular, the timekeeping for the day; the afternoon or evening should be usually selected for this purpose, as the timekeeper will then have most of his day's record entered up, but it should also be varied by an occasional inspection in the morning, before the checks for the first quarter of the day are returned to the gate office. This is in accordance with the plan adopted by the railway companies of surprise examinations of tickets, and derives its force as much from the fear it inspires of detection as from the detections which it actually effects.

Payment of Wages.—It is decidedly better to pay wages at one or two places in the yard, which the men pass on leaving, than to send the money into the various shops during the time they are at work. The latter plan causes confusion and disorder, which may sooner or later entail accident, and the employers' heavy liability for accidents must now be remembered. The cashier should, on pay day, prepare a paper showing the number of sovereigns, half sovereigns, florins, &c., &c., which he will require, and the amount thus shown must agree with the total of the wages book. The method of doing it is well known to most pay clerks in textile and other manufacturing works, as well as engineering establishments; we have even seen it used by a half-caste paymaster on the *Desagüe del Mexico*.

The wages for each man should be counted out and examined before the pay commences. Boards with holes sunk in them may be used for the purpose, or little tin boxes. Whichever plan is adopted they must be arranged by numbers, and the men must apply for their pay by numbers instead of by name. When the tin boxes are used it is better to have boards arranged into which they fit.

For either plan it is desirable to put in with the money a slip containing the man's number, and the amount of his pay, after the manner of the textile factories. In one of these we have seen an excellent plan of working. The numbers were printed on perforated slips, and the pay clerk took his wage book and called out to an assistant the amount of each man's wage which was entered on his slip. A summary of the totals of the various columns of these slips was made on a sheet of scrap paper to prove their agreement with the total of the wage book. The money was then distributed into the tins from these slips, and not

from the wages book, and by this means two or three clerks could be employed on the work at the same time—one for each board, if needful.

When the money has been sorted out by the pay clerk, the secretary or general manager (according to the authority they respectively take over the office staff), may, with the assistance of the accountant, or a reliable clerk from the general office, occasionally compare a number of the receptacles, taken up and down the boards at random, with the wage book. It is not necessary to do this every week, but if it is adopted in the nature of a surprise visit, which may come any week, and will come some time or other, it will tend to prevent *intentional* mistakes being made. It is dangerous to substitute sixpence for a half sovereign if the secretary may come in any moment, and possibly pick up that particular box, and count the contents.

Disputes as to Wages.—The men should form a *queue*, and call out their numbers as they pass the office window, and walk on immediately they receive their money. No disputes as to rates of pay, time, or calculations must be permitted at the immediate time, if their money agrees with the slip. They must wait until the pay is over, then complain of the error to the pay clerk, and receive from him an appointment for their attendance the next morning, when the dispute can be investigated, and adjusted.

Payment of Absentees.—When men are working away from the factory their wages can be remitted to them by the cashier, with a note of the amounts for each man; or arrangements may be made for their payment by the customer, such payment being subsequently arranged as a matter of account between the two firms. No difficulties can arise in either way as a mere matter of bookkeeping, if proper care is taken, nor do either of them present any great danger of loss of the money. When men are absent through sickness, or on leave of absence, or from any other cause, their wages must only be paid to some person authorised by them to receive the money, and who presents on each occasion a duly-signed written authority. A receipt must be signed on this note, and such payments should, therefore, to avoid delay, only be made after the ordinary pay is completed. Of course, there is an obvious exception to this rule; if the workman is so ill that he cannot write

or sign his name, the money should be handed to his reasonable representative; he should not be further punished for his misfortune.

Unpaid Wages.—Unpaid wages should be picked off the boards by the cashier, and the men's numbers and amounts entered in a small memorandum book. They will be paid afterwards when applied for at the cashier's office, but should not be added to the sums placed on the boards the following week. Should any remain unpaid for a length of time, and apparently unlikely to be applied for, they can at stocktaking be transferred to the cash in hand, and through a cash book entry credited to one of the expenditure accounts: management wages and salaries would be a suitable one.

Issue of Materials.—It is quite as important that materials should be systematically dealt with, as that the work of men should be properly regulated and recorded. Workmen's neglect and loss of time will injure the firm and reduce its profits, but loss or waste of materials will equally inflict damage. The first need in the system is that they should not be drawn from the stores without sufficient authority. And this authority must in all cases be a written document, and not a verbal order.

Each foreman must be furnished with an order book, with counterfoils to retain for his own reference. The form may be very simple, thus:—

THE CLYDESDALE ENGINEERING CO. LIMITED.		THE CLYDESDALE ENGINEERING CO. LIMITED.	
..... 189...		..... 189...	
Please supply		Please supply	
	Order No.		Order No.
..... Foreman.		..... Foreman	

The particulars given of the materials required must, however, be sufficiently complete to ensure the storekeeper issuing just what is required, and the order number and detail (process) must invariably be inserted. Carbon duplicate books may be substituted for the counterfoil form, but there is one trifling objection to them, the carbon papers will generally be missing just when they are wanted.

Removal of Materials from Stores.—The transfer of small and light articles from the stores to the shops presents few features of interest. The order will usually be sent to the stores by an apprentice or a boy, who will return with the rivets, nails, portions of steel, or other goods demanded. There is little room here for economy by the substitution of mechanical appliances for manual labour, though something may be effected by judicious issuing of orders, so as to avoid unnecessary journeys. But when the goods are either bulky or heavy, considerable economy may be obtained by the use of light tramways, or overhead conveyors, or frequently by a combination of the two. Nor is the saving in wages the only gain to the firm. By the use of appliances of this kind the danger of accidents will be reduced, and this has become an important consideration to employers under stress of recent legislation. If the tramlines are only for running light trolleys within the works they will be of narrow gauge, and laid with light rails; and the cost will be so trifling in comparison to the advantages, that no hesitation should be felt in extending them throughout the yard, and into the ground floors of all the workshops. The lines should always be kept free from obstructions, and this regulation should be draconically enforced. Labourers are inclined to deposit bulky and heavy articles in any place they may deem convenient, without consideration of the trouble they may cause to others following them.

The form of the overhead conveyors must be determined by technical considerations, and by the construction and disposition of the buildings. The facilities afforded by modern electrical appliances may frequently prove the most convenient and economical method of load transport. The commercial question is the substitution of mechanism for manual labour; the manner and kind of substitution is a matter for the decision of the technologist.

Determination of Relative Transport Costs.—It may sometimes be desirable to compare the relative costs of manual and machine transport, and indeed of other machine substitutions, in greater detail than can be obtained from ordinary cost accounts. The analytical method, suggested for piece-work prices, may be employed for this purpose. The men's time must be reduced to units of work and cost, to ensure the comparison being made only on such work as is being transferred from the

men to the machine. The value to be attributed to the machine (it matters not whether it be a tramline, electric carrier, or overhead wireline, they may all be termed "the machine" for present purposes,) is not the amount of work which it can discharge if forced to its full capacity, but the amount available for it in the yard or shops, and which is within its capacity to perform.

The basis for calculating the cost of working the machine, for comparison with the cost of manual labour, is as under:—

1st. Interest on the amount paid for the machine, and all necessary appliances, erected and fixed in place. When debentures or preference shares have been issued, the interest will be the same as that paid on such debentures or preference shares; where the capital of the company has all been raised in ordinary shares, or where it is a private firm, it will be the rate at which money can be borrowed, if needed, for machinery purchases or extensions, usually not less than 4 or 5 per cent.

2nd. Depreciation, calculated on the estimated life of the machine.

3rd. Repairs of the machine, such as are necessary for keeping it in running order, but not for developing or improving it.

4th. Cost of operating the machine, including not only the wages of the man or men working it, but also coals, oil, tallow, &c., or power supplied for that purpose.

The amount thus arrived at must be reduced to the same units of work and cost as the manual labour, and a comparison of the two methods will show the relative gain or loss by the adoption or proposed adoption of machinery.

It will be observed that nothing is added to either calculation for management, or those miscellaneous items which make up what are usually termed establishment charges. The reason is obvious. Although the incidence of the charge may be altered a little, the alteration in working will effect no reduction in office expenses, in lighting, in rates, taxes, and insurance, nor affect the receipts or allowances of discounts. The payments will go on just as before, and to include them in these calculations is to introduce a pedantic complication.

Collection of Materials.—It is important that sufficient arrangements be made for the collection of materials, both

those for use in the shops, and those which are completed, and merely waiting erection.

The primary collection is in the stores, and ample floor space, and convenient fittings should be provided there. The exact form of the stores, and of the shelves and cupboards therein, will vary in different works; the important matter is that they should be sufficient to accommodate all the materials without overcrowding. In most engineering stores it is desirable to provide a large number of small bins or pigeon holes, so that nails, rivets, screws, and small articles of that kind may be conveniently placed for issue. No storekeeper can properly discharge his duties, and execute his orders rapidly, unless his store room is sufficiently and thoroughly equipped for its special purpose.

But it is equally desirable to have proper collecting places in the shops themselves, both for deposit of materials on which work has to be performed and for storage of machine parts which have undergone some process. Although some of the more modern workshops in England are fairly well arranged in this respect, many of the older shops have no proper receptacle wherein to place either stores drawn for work or finished materials. It is not now always possible to arrange a better plan, as the shops are crowded with machinery, and afford no room for further permanent erections without extension of the general boundaries of the buildings. In such unfortunate position there is no alternative but to store the materials against walls, in corners of the room, or on other unoccupied places on the floor; but even then something may be done to avoid disorder by collecting all the articles for each order into a separate group.

It is to America, however, that we must turn for example of the order, and even beauty, which may be imparted into the workshop by the provision of a few cupboards and bins. The Americans are inventive of labour-saving devices for office work; some of the most useful desks, files, and indices are the result of their busy brains; and all these devices are but the carrying out of our old adage: "A place for everything, and everything in its place." They have continued the same principle into the workshops, and excelled the generality of our English works in this—that they have been careful to provide "the place" as well as insist upon things being placed in it. It is a positive pleasure to walk through one of their rooms and see the absence of unsightly piles of

materials not in actual use, and to turn to the cupboards, floor bins, and other receptacles, and there view each order, or portion of an order, collected in its own proper place. These receptacles are usually labelled with the number of the order, and this is an easy way of preventing confusion.

There is more than immediate time saving in such methods as these. It is well known that literary men, artists, and even clerks are more irritated by little obstacles to their work, by removal of their materials, or loss of some of their papers, than by much greater difficulties. It is exactly the same with the workman. The man who will, unmurmuring, hour after hour work with file and chisel to complete a difficult fitting will break into expletives if a tool or trifling scrap of metal is missing from its accustomed spot. Disorder causes irritation, and irritation breeds delay or bad work, and the firm loses more than managers imagine, or than statistics will show, because an infinitesimal expenditure on workshop accommodation has been niggardly refused.

Stores Issue Book.—Reverting once more to the issue of stores by the storekeeper on presentation of the foremen's orders, it is apparent that a record must be kept of those issued with the same exactitude as of those received. The giving out of such goods is frequently carried on under great pressure; men and boys are arriving with orders, and impatient to have them executed, for their leading men and foremen are keeping note of their absence and return. It is therefore frequently difficult to make entries in a permanent book of record at the moment of issue, and the issuer (whether storekeeper or one of his assistants) must content himself with marking on the foreman's order the exact weight or quantity given out. Such orders should be placed on an upright wire file, kept conveniently near to the issuing counter. But this expedient must only be regarded as temporary, and as soon as there is a lull in the work the entries must be made in the permanent issue book.

A convenient and practical form of book for this purpose is the one on the following page.

The date will, of course, be the date of issue, and the next column will contain the name of the foreman signing the order for the goods; he has demanded them, and from the time they leave the stores he is responsible for their safe custody, and for their proper use in the service of the firm.

STORES ISSUE BOOK.

Date.	To whom issued.	For what process.	Goods.	Quantity.	Price.	Amount.	Total issues per process.	Name of process.

And for the purposes of accounts this "proper use" means use for, or on the particular section of work for which they are issued. It may seem a small matter that stores issued for the section of order 5746 represented by the symbol M.M.B.—6 should be used for a detail of order 5739, or for repairs of some part of the company's plant; it is legitimately used in the service of the firm, and for its benefit; and indeed such user has the advantage of saving a journey to the stores. But a moment's consideration will show that such irregularities will absolutely prevent the correct keeping of cost accounts, and if cost accounts are kept at all they must be as nearly absolutely correct as human forethought and careful effort can make them.

The entry in the column "For what process," will be made from the foreman's order, which contains a space marked "order number." It will be remembered that when starting a man on a new job, or when changing him from one job to another, his foreman is to mark his time ticket with the number of the order, and symbol of the special detail (or as we term it in this issue book, and in the cost accounts, "process") of the work, thus:—

5746
M.M.B.—4.

A similar marking must be made on the stores orders he issues, so that both the order and process may be identified with the goods issued.

The quantity will, of course, be the actual number, length, measure, or weight of the articles issued. The price, however, requires some little consideration. It has already been said, when considering freight and cartage in reference to cost accounts, that "the cost of an article is the invoice price of it plus the amount which has to be

paid for delivery at the works, and on the cost thus arrived at, the issue price of it by the storekeeper should be based." This involves calculation, and when this has been made the result should be entered at the top of the stores ledger, so that it need not be made afresh every time there is a delivery to the shops.

There is another point to be remembered in connection with this price. Goods bought at various times will vary in their cost, some classes only slightly, but some kinds very considerably. Markets, it must be remembered, are in a state, or approaching a state, of unstable equilibrium, and this constant condition affects the purchases made by the firms, as well as its sales. Now as to special purchases for a particular contract, such as steel plates and angles for a caisson, or railway bridge, or compressors for a steamer, these will be charged in the invoice book to the department first receiving them, and for the order and process for which they were specially procured. No difficulty will therefore arise with them. But with general stores, such as screws, rivets, oil, paint, and the thousand and one articles which pass under the storekeeper's ken, the case is different; it is sometimes hard to ear-mark any particular issue, and say from which identical purchase it is made. As a rule, therefore, it must be assumed to be from the oldest purchase of which any portion remains in stock, and the issue price will remain unaltered until the lot has been exhausted; and so on from purchase to purchase.

In actual practice it will sometimes be found difficult to obtain a workable fraction for the issue price, and so long as our coinage remains on its present basis, it is not advisable to adopt decimal points. The only way to do is to adopt the nearest workable fraction, and if it be practicable, to make an adjustment in fixing the next issue price. It is desirable that these prices should be checked by the accountant, or a clerk from his office, except in those large establishments where the storekeeper is the head of an independent department, and assisted by an efficient staff of bookkeepers and clerks. Even then an internal audit has its advantages.

The first money column, "Amount," will be a calculation of each item at the price fixed for issue. The second money column is inserted to facilitate the work necessary for keeping the cost accounts, and for returns to the accountant. In any one day there may be several issues for one process, and it is convenient to summarise these

Amount.			Total Issues per Process.			Name of Process.
				13	6	5746/ M. M. B.—4
			1	4	2	5746/ M. N. B.—2
			18	9	6	5750/ S. E. D.—6
				2	1	5746/ M. M. B.—3
				1	6	5747/ M. M. D.—7
				2	1	5749/ S. E. F.—2
			4	1	6	5849/ S. E. F.—13

in the second cash column at the end of each day, the last column serving to indicate the process or details against which the summarised accounts are chargeable, as shown in preceding table. Additions of both money columns must be made, and the two must agree in total amount.

Posting of Stores Issued.—The stores issued must be posted to the credit side of the stores ledger, just as those received were posted to the debit side. It is always objectionable to multiply books, if by any means the increase can be avoided, and it is therefore better to make the postings direct from the stores issued book, if this can be managed without the ledger entries being inconveniently or unmanageably long. This, however, is difficult in a general works making a large variety of articles, and is almost impossible in a large establishment. For posting purposes it is better to prepare an abstract (form annexed) on wide sheets of paper, and to post the weekly or monthly totals of this abstract to the several stores ledger accounts.

It may possibly be asked why an analysis of this kind cannot be made in the issue book, and so save the trouble of an additional book or sheets. The answer is very simple. There would not be sufficient space in any possible book for the number of columns required. In most works two, three, or more abstract sheets will be found requisite for this purpose, even when a large size of paper is employed.

Return of Stores Issued for Accountant.—The wages abstract will usually be available for use in the accountant's

[illegible]

office, and it may not be needful in many establishments to make a copy or summary of it for such purpose. With the stores account, however, it is different. The storekeeper cannot spare his books away from his own office; he is constantly requiring them, and must always have them ready at hand to employ his leisure in completing the entries. If he had to send them to the general office some junior clerk would be asking for them at inconvenient times, and it would be impossible for the storekeeper always to ascertain that he had not some superior authority for the requisition. It is just such trifles as these which lead to friction, and they should be avoided on all possible occasions.

The storekeeper should therefore furnish the accountant with a monthly abstract or return, which may be made out on a sheet or sheets of ordinary double column foolscap. This can be used for the purposes of both the financial books and the cost accounts, if sufficient information be given, and it will therefore save time and trouble to give full details in the first instance, in manner following:—

RETURN OF STORES ISSUED FOR MONTH ENDING
30TH SEPTEMBER, 1898.

On what account.		£ s. d.			£ s. d.		
5746	M. M. B.—4	2	12	0			
	„ —2	3	12	6			
	„ —3		10	5			
	„ —7	1	10	2			
5750	S. E. D. —6	20	7	1	8	5	1
	„ —8		10	4			
5747	M. M. D.—7		12	6	20	17	5
	„ —8	1	1	2			
5749	S. E. F. —2	2	1	3	1	13	8
	„ —4		1	7			
	„ —13	5	2	1			
					7	4	11
					£38	1	1

It will be seen that the return contains only a summary of the issues during the month for each order, and the process, or detail, of the order; the process issues being needful for the cost accounts. The storekeeper can have no difficulty in preparing this summary from his issue book; it is only making a few additions on some scraps of waste paper, and it is quite unnecessary to encumber the return with all the figures. The total must agree with the total of the issue book for the month.

Posting of Stores Issues in the Financial Ledger.—

If we refer back to the stores account in the financial ledger it will be seen that it is debited with all materials received and handed over to the storekeeper's charge, and that the amounts so debited must each month agree with those in the stores received book. It is necessary to now credit this account with the stores issued, so that it may show, as already intimated, the balance of stores on hand at any date to which it is written up.

But before this can be done the directors, or secretary, or the manager if he has control of the accounts, must determine the form of the trade account, at least to a sufficient extent to allow of the ledger accounts being so arranged as to supply the information required for that purpose in a convenient form. Of course it could always be obtained by an analysis, but this involves additional unremunerative expense.

The stores account (or, as some accountants term it, "the general stores account") will be credited by transferring the amount issued to one or more expenditure accounts. Thus, taking the example last given (which, however, will only represent a minute portion of the month's issues if it be compared with the purchase example), the amount may be transferred to an account termed,

"STORES EXPENDED ACCOUNT,"

and the entries in the two accounts will then be,

STORES ACCOUNT.			CR.			
1898. Sept. 30.	By Stores Expended	Led. 53	38	1	1	

DR.		STORES EXPENDED ACCOUNT.						
1898. Sept. 30.	To Stores a/c	5746	Led. 17	8	5	1		
		5750	„	20	17	5		
		5747	„	1	13	8		
		5749	„	7	4	11		
							38	1 1

It will be noticed two money columns are used in the latter account, and it may be observed that double money columns are the most convenient form for the nominal ledger accounts throughout. A journal can be used for these transfer entries, but is not absolutely necessary; indeed, it may safely be assumed that the journal can advantageously be dispensed with in the great majority of entries of this kind. It is heterodox to say so, but is perfectly true in practice. The best public accountants seldom use journals in drafting their entries.

In a large establishment, however, the “stores expended account,” would become unmanageably cumbersome, and would altogether fail to show, in the official records of the company—that is, in the books submitted to the auditors investigating them on behalf of the shareholders—the direct expenditure on any contract or contracts. A far better method is to open a ledger account for each contract, and debit it with the stores purchased for and charged to it through the invoice book, or issued for it by the storekeeper. The same account would be debited with the wages directly paid on that contract, and also with any cash book expenses, but not, in these accounts, with any portion of the management expenses. We should then have in the financial books such expenditure accounts as the following:—

Directors’ Fees.

Salaries.

Rent, Rates, Taxes, and Insurance.

Royalties and Legal Expenses.

Stationery.

Gas, Water, and Coal.

Oil and Waste.	
Machinery Repairs.	
Travelling Expenses.	
Loose Tools.	
New Machinery.	
Contract No.	5746.
„	5747.
„	5749.
„	5750.

These contract accounts would show the gross expenditure on each several contract, and also the amount received for it, the difference between the two sides being the gross profit or loss. There would not, however, be included in them any portion of the management expenses.

CHAPTER XVI.

COST ACCOUNTS. DEPRECIATION. INTEREST. ESTABLISHMENT CHARGES.

BUT, as already stated, it is needful that the engineer should have, in the form of detailed cost accounts, more minute information than he can obtain from his ordinary business books. The keeping of accounts is not "commercial management," but only a portion of it; such accounts are, however, a very necessary portion, since they exhibit the actual results in money, of the technical arrangements made in the works, and exhibit the profit or loss in various sub-divisions or sections arising from such arrangements. It is therefore desirable to examine the form and conditions of these cost accounts in greater detail than has hitherto been done.

Cost Sheet A.—Of the three-fold division of cost accounts, to which we have already referred, the most difficult is the first or A account, because in it the distribution of the wages and materials has to be made over the various contracts, repairs, and other jobs in the yard. The cost accountant has no easy task in compiling this sheet; he will need unwearying patience, great care, and accuracy, and the kindly co-operation of the technical officers. It is desirable, and indeed almost essential, that he should have considerable knowledge of the business of the firm and acquaintance with the class of machinery on which it is usually engaged; not, indeed, in a technical sense, but in a very complete commercial manner, sufficient to qualify, or even more than qualify him in this respect for a very excellent commercial traveller. He must know the different parts of a machine and the names by which they are described in the drawing office and the works; and when the symbol system is used he must be acquainted with all the symbols employed. Indeed, in the latter case it is better for him to have a symbol book at hand for reference: it can be copied from the drawing-office book without any great labour.

There is a sequence in the division of cost accounts, the

first taking the wages and materials as they pass into (to the debit of) a department, and passing them out again dissected into charges against various machines or portions of machines; while the second section collects the charges against each individual item from all the various departments of the yard, and the third finally collects the several accumulations of the second section into a total charge against the completed machine or other construction. So also there is a sequence in the first or A sheets, some of them being cleared by transfer to subsequent sheets of the same class, whilst these latter ones are only cleared by transfer to the second, or B class of account. We will deal with the former description first.

Whether books should be used for the purpose of cost accounts, or loose sheets, is a matter for determination of each individual firm, according to the special conditions of the work done by it. Books are certainly more permanent, and less liable to misplacement than loose sheets, but the matter is one on which no definite rule can be laid down. One firm, which only required the A form of account (it was not an engineering firm) always used loose sheets, and the conditions and variations of the work were such that a book would undoubtedly have been inconvenient. In such case, however, the sheets of the first division should be made up into monthly bundles, and placed in a convenient and locked drawer, cupboard, or safe. It is unnecessary to say that cost accounts are very confidential documents, both in their custody and compilation, and that the contents of them must never be disclosed to any unauthorised person: the general defect is to raise this secrecy into a kind of fetish, and withhold the cost accounts from technical officers who might be most forcibly admonished by them.

Management Expenses: Form A.—Among the earlier series of A accounts will be such as office expenses, carting establishment, storekeeping, timekeeping, drawing office, and management expenses. The number and titles of these accounts will be a matter for internal arrangement by each firm; they will all be apportioned over others at a later stage, and may be either under half a dozen different headings or included under management expenses. The account will be more easily understood by example, and a model form is therefore annexed. The title used is management expenses, but it must be understood to include general office expenses, timekeeping, &c.

SHEET A.

MANAGEMENT

DEBITS.	Quantities.	Materials and Expenses.	Salaries and Wages.	Trade Debits.
Stock, January 1st, 1898		106 10 0	...	106 10 0
Purchases—				
Alexander Thompson, Stationery		15 6 0	..	15 6 0
Hudson and Kearns, do.		1 9 6	...	1 9 6
Salaries and Wages—				
Directors' Fees	50 0 0	50 0 0
Secretary's and Manager's Salaries	100 0 0	100 0 0
General Offices	71 6 8	71 6 8
Subordinate Officials	33 6 8	33 6 8
Cash Payments—				
Postage and Receipt Stamps		5 4 2	...	5 4 2
Travelling Expenses		37 9 8	...	37 9 8
Petty Cash payments		18 4 2	..	18 4 2
		184 3 6	254 13 4	438 16 10

The account will be seen to follow the usual outlines of an ordinary departmental trading account, except that the materials and expenses are separated from the salaries and wages, distinct cash columns being used for the two characters of expenditure. This is in accordance with the principle on which the estimates are framed, and furnishes an additional division, which is extremely useful in judging of the financial results of the working, and of the abilities displayed by the various officials exercising authority within the establishment. A third cash column is added for trade debits, or credits, the use of which will be considered at a later period.

Debits to Account.—If the debit side of the account be first considered, it will be noticed that the first entry is stock on hand on the 1st January. This is the same amount as was shown for the closing entry of the credit side of the account on 31st December, 1897. It arises through the general office expenses being, in this example, included with the management expenses, and represents the value of the stationery on hand at that date.

EXPENSES.

JANUARY, 1898.

CREDITS.	Quantities.	Materials and Expenses.	Salaries and Wages.	Trade Credits.
Transfers to Departments—				
Pattern Makers	$\frac{1}{20}$...	2 5 4	10 16 8	13 2 0
Moulders ..	$\frac{2}{20}$...	4 10 8	21 13 4	26 4 0
Blacksmiths	$\frac{4}{20}$...	9 1 4	43 6 8	52 8 0
Turners	$\frac{6}{20}$...	13 12 0	65 0 0	78 12 0
Fitters ...	$\frac{7}{20}$...	15 16 10	75 16 8	91 13 6
Transfers to B and C Sheets—				
B Sheet, Milford Dock gates, expenses for Estimate and Tender...		25 17 4	38 0 0	63 17 4
Stock, January 31st, 1898		113 0 0	...	113 0 0
		184 3 6	254 13 4	438 16 10

The next items are for purchases. All purchases are obtained from the invoice book, the analysis columns on the right-hand side of the book furnishing the amounts. We have not in this instance assumed any issues from the stores for office use, but these will occasionally be made. When they are the amounts will appear as "transfers from departments," and follow the items for salaries and wages.

The salaries and wages will be gathered from two sources of information, namely, the cash book, and the abstract of wages compiled from the wages book. It will be evident that directors' fees, and the salaries of the general manager, the works manager, or the secretary, will not be passed through the weekly wages account; nor will the salaries of the accountant, cashier, correspondent, and principal general office clerks, in factories of any pretensions. These must be obtained from the cash book, or from a salary book, if such a record is kept of the monthly salaries paid. On the other hand, the junior clerks, office boys, messengers, with writers and assistants of various degrees, will be paid weekly, and the total amount

so paid to them will appear on the wages abstract under the head of "Management expenses" or "General office expenses," &c.

The cash payments shown in this example are all obtained from the analysis made of the petty cash book, divided into postage and receipt stamps, travelling expenses, and general petty cash payments. It is seldom that any other payments of this kind will pass through the general cash book, either for management expenses or for any of the departments. No doubt for the departments there will be, at times, purchases of materials to be used on some special contract which do not pass through the stores account, but the debits for these are obtained from the invoice book under the head of purchases; the cash paid will pass to the debit of the personal accounts of the vendors. An analysis of the petty cash expenditure has to be made each month by the cashier, as already explained when referring to his duties.

Credits to Account.—The debit side of a sheet requires great care on the part of the cost accountant, but does not involve much calculation. The purchases and wages are already dissected for him in the invoice book, and wages abstract, whilst the cash payments are also analysed by the cashier; all he has to do is to copy the figures correctly into his sheet. When, however, he comes to the debit side, he has both to exercise this clerklly care, and considerable discretion in dealing with any temporary or special expenditure, and has also to make a few simple calculations to arrive at the apportionment to the several departments. In the example given we have supposed the total departmental wages to be divided into twenty parts, one of which has been spent on pattern makers, two on moulders, four on blacksmiths, six on turners, and seven on fitters. It is in these proportions, therefore, that the management expenses will be divided.

It has already been stated that the percentage of establishment charges in estimates should be based on the wages, and not on the materials, or on wages and materials combined. If this is necessary in estimates, it is equally so in dealing with the results of them, not only because, as already stated, materials considerably vary both in price and condition purchased, but also to secure an easy comparison between the anticipated and the actual expenditure. It must, however, be always remembered that in the former

case both establishment charges and wages are hypothetical, although based on the best information obtainable at the time by the estimator, whilst in the latter they are actual money paid, or liabilities incurred; there must be no guess work in cost accounts.

The debits for materials and expenses, including the stock on hand on 1st January, amount to £184 3s. 6d., from which must be deducted £113, the value of the stock remaining on hand at the end of the month. This leaves the expenditure at £71 3s. 6d. During the month, however, the directors have been negotiating for the construction of dock gates at Milford, and the expenses of the directors and staff engaged on the work for travelling, postages, &c., amounted to £25 17s. 4d., which must be deducted from the last-named amount, in order to arrive at the balance properly divisible over the general work of the establishment. The amount then left is £45 6s. 2d., which, as will be seen, has been apportioned to the departments in the proportions named of one, two, four, six, and seven twentieth parts. When this has been done it will be seen that the debits and credits for materials and expenses balance each other.

The same method has to be pursued with salaries and wages, though here there will not usually be any such item as appears in the previous columns for stock. It is usual to allow, in trade accounts, for the portion of a week existing between the date of the last pay sheet and the end of the financial year, in addition to the last week's wages if then unpaid, but it is unnecessary to do this every month in cost accounts. An adjustment of the kind can be made at the close of the financial year, or half-year, in order to make them agree with the trade account of the firm.

Salaries and wages, including directors' fees, are £254 13s. 4d., from which must be deducted £38, the proportion chargeable to the Milford Dock gates, leaving a balance of £216 13s. 4d., which is divided over the departments in the same manner and in the same ratio as the materials and expenses.

Direct Charges for Special Purposes.—There is sometimes difficulty in arriving at such charges as those indicated for the dock gates, and the cost accountant must obtain the aid of the technical officers, and others concerned, in fixing them. The expenses are usually easily obtained, since the cashier should have particulars of the work

respecting which journeys are made, or payments incurred, on the receipts given him: but the time is more difficult of apportionment. The directors, for instance, and the manager also, when taking a journey to South Wales would employ their time in consultations upon the general work of the firm, as well as the particular dock gates they were seeking to secure; and the charge to be made must therefore be largely a matter of adjustment, viewing all the circumstances of the particular case. Such adjustment must not be attempted by the cost accountant; he must obtain the information from the secretary on behalf of the directors, and from the other technical officers so employed. Of course it would be possible to allocate the time of those employed on the management staff, by requiring them to keep diaries of their work, after the manner of solicitors, but would the result be worth the trouble incurred? The manager, for instance, would find a considerable portion of his day employed in writing up his diary.

Cartage, Coal, Water, Drawing Office, and other Establishment Costs.—All the various establishment charges of the firm must in similar manner be collected into A sheets, in the first instance, and transferred from there to departmental A sheets, or to B sheets opened for the purpose of any special contract. It is possible to have only one account for all these varied classes, and call it management expenses, or any other convenient title, but this is doing exactly what engineers invent cost accounts in order to avoid, namely, grouping together a number of items so as to give one generic result, but without showing the details upon which it is based. It is desirable to have such costs as that of a carting establishment, or of the drawing office, or even of fuel and water, in a form which will show them separately, and the incidence of each to the wages expenditure when transferred to the departmental accounts. The form and method of compilation and transfer will, however, follow the same general lines as the example already given.

The few deviations which are desirable may readily be indicated in considering the sheet for a carting establishment. It must be understood that no capital charges, either debits or credits as capital, shall appear in the cost accounts; they are revenue accounts pure and simple, and even when a new machine is made for the works, and appears on the credit side of the account eventually as an

addition to machinery, this entry is merely in the nature of a transfer from revenue to capital, and does not require, nor permit of, any mixture of the two accounts. The stocks at the commencement and end of the period must, therefore, not include such things as loose tools, horses, carts, harness, or ropes and boats. The stock which is, however, permissible, should be set out in some detail, as for instance—

	T.	c.	q.	lb.	£	s.	d.
Hay.....	6	7	0	0	21	3	4
Straw	8	6	0	0	11	12	8
Beans					5	1	3
Indian corn					1	6	9
Peas					1	10	9
					<u>£40</u>	<u>14</u>	<u>9</u>

The cash payments will hardly comprise anything beyond carters' expenses when away from the works, and these should be restricted as much as possible. It is better for the carter to take a bag of feed with him than to purchase it at a roadside inn. In the former case the horses are pretty sure to have the benefit of it; in the latter, at least a portion of the charge may be appropriated by the driver.

The transfers to B and C sheets will be more numerous than in the sheet for management expenses. Whenever a journey is made for one sole purpose, and for one sole order, or even when goods for two orders are involved, and the services can be apportioned, the cost of the journey must be charged to such order or orders. This reduces the amount of divisible charges, a result always desirable. Of course the cost of bringing miscellaneous goods into the yard for general stores purposes cannot be charged to that department, as it would involve an enormous increase in the work of calculating the issue prices. It must be divided over the several departments after the manner of the management charges.

Depreciation.—Before proceeding to the departmental accounts there are two establishment items which require attention: these are depreciation and interest. The first is a difficult one to deal with, more particularly as it has, unfortunately, got largely into the hands of auditors and bookkeepers, who deal with it according to their own limited knowledge and entirely as a matter of account. Depreciation is much more than this, and can only be properly adjusted by an engineer who has thorough knowledge of his profession and intimate acquaintance

with the particular buildings and machinery with which he is at the moment dealing. Two methods may be adopted: first, that of writing off a percentage from the original cost; secondly, that of reducing the original cost of each item by a fixed yearly sum, which shall, in a certain number of years, to be determined by the estimated life of the item, entirely extinguish it.

But, whichever method is adopted, it is essential that a proper schedule of the plant be kept, and that this schedule should show the variations which may from time to time take place. Table A of the Companies' Act, 1862, says: "The directors shall cause true accounts to be kept of the stock-in-trade of the company . . ." Whatever the present legal interpretation may be, there is no doubt Parliament intended at the time that "stock-in-trade" should include machinery and mill gearing, whether or not it also comprised the buildings holding them. Apart from the legal obligation, however, such a record is necessary to enable the management to keep proper control over the plant on the premises, more particularly over such portions of it as may, occasionally, be removed from one shop to another. Such an article as a lathe is not likely to be stolen, or taken from the premises without

MACHINE

Class.	Date of Purchase.	DESCRIPTION.	Purchase Cost.		
A			162	0	0
			178	0	0
			154	0	0
			57	0	0
			81	0	0
			84	0	0
			44	0	0
			60	0	0
		Total of Class A	820	0	0

sufficient authority, but it may appear twice in stock-taking if proper record is not in existence. We have actually known such a case. In December a lathe was entered on the valuation of Room C, where it was at the time fixed; in the following June it was continued on the Room C valuation and also entered on the Room E list, it having been removed there in the interval. In the case of a liquidation a blunder like this might subject the officials to an unpleasant inquisition. The schedule should, therefore, be complete by rooms or shops, and not be merely an unbroken list for the entire works.

When the percentage method is adopted the buildings and plant should certainly be divided into different classes, and this division should be made after taking into account the probability of improvements in any of the machines, as well as the extent of wear and tear. We know one firm which divides its plant into six classes, the depreciation on which ranges from 5 per cent to 22 per cent per annum. The particulars required are the date of purchase, the description of the machinery and appurtenances, the purchase cost and the depreciation written off. Many firms will no doubt have such records already in existence. To those who have not, the accompanying form will be found useful.

SHOP.

Balance brought forward.	Year ending Dec. 31, 1898.						Year ending Dec. 31, 1899.						Year ending Dec. 31, 1900.							
	Depreciation.			Balance carried forward.			Depreciation.			Balance carried forward.			Depreciation.			Balance carried forward.				

In this example it will be seen that the purchase cost is inserted for each machine and a total made at the foot of the class concerned. The depreciation, and resultant balance, are, however, only entered against the total, thus giving one calculation only for the class, whilst keeping a description and record of each machine.

Depreciation by Individual Machines, &c.—Depreciation by classes is undoubtedly a great improvement on the method frequently, if not, indeed, generally, adopted, of writing off the same percentage from all buildings, and a second rate from all machinery, without any consideration of the special circumstances which may affect and curtail their life. It is also a more satisfactory method than revaluing the fixed plant at each stock taking, which, when made by a member or interested official of the firm, is unconsciously computed in the most favourable manner. Every inducement, and certainly every facility, for manipulating the profit and loss account by means of depreciation, should be removed; since errors in judgment, and blunders in management may be disguised by such

BUILDINGS AND

Description.	Value, Jan. 1st, 1894.	JANUARY.		FEBRUARY.	
		Deprecia- tion.	Value, 31st.	Deprecia- tion.	Value, 28th.
		£ s. d.	£ s. d.	£ s. d.	£ s. d.
Building of fitting shop..	162 10 0 {	Life, twenty 1 2 11	161 7 1	years, from 1 2 11	160 4 2
10 in. centre gap lathe, } No. 1	57 0 0 {	Life, twenty 0 7 11 From fitter's cost	56 12 1	years, from 0 7 11 sheet	56 4 4 10
Bradbury shearer and puncher	81 0 0 {	Life, twenty 0 11 3 ...	80 8 9	years, from 0 11 3 From fitter's	79 17 6
10 in. centre plain lathe, No. 2 ..	84 0 0 {	Life, twenty 0 8 9	83 11 3	year, from 0 8 9	83 2 6
5 in. centre Bradbury capstan lathe, No. 3. }	44 0 0 {	Life, twenty 0 4 7	43 15 5	years, from 0 4 7	43 10 10
7 in. centre Bradbury capstan lathe, No. 4. }	60 0 0 {	Life, twenty 0 6 3	59 13 9	years, from 0 6 3	59 7 6

means, and the improper valuations, whether intentional or inadvertent, are most difficult of detection by the auditor.

There are, moreover, additional advantages in dealing with such machines individually. The depreciation of the machinery used in any department is part of the expenses of that department, and, as will be seen, is debited to it in the cost accounts. But if the calculation is made by classes a double classification will be required to effect this purpose. First, a classification by shops or departments; and secondly, by the classes within those shops, and the saving in trouble will thus be reduced to a minimum. Again, when a machine is removed from one place to another, the transfer, if made, requires a fresh calculation of the balance on both pages, and if two or three removals are made in one year the alterations will be unsightly, and probably perplexing. But the greatest objection arises from the research and developments of modern engineers; from the restless spirit of improvement which actuates them, and which may at any time put a particular machine out of date for economical use. All machines are not affected to

PLANT.—FITTING SHOP.

MARCH.		APRIL.		MAY.		JUNE.	
Deprecia- tion.	Value, 31st.	Deprecia- tion.	Value, 30th.	Deprecia- tion.	Value, 31st.	Deprecia- tion.	Value, 30th.
£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
January, 1885.		Cost	£300, less	old bricks,	£25.		
1 2 11	159 1 3	1 2 11	157 18 4	1 2 11	156 15 5	1 2 11	155 12 6
January, 1888.		Pur-	chased at	£100, less	scrap, £5.		
0 7 11	60 5 8	0 8 6	59 17 2	0 8 6	59 8 8	0 8 6	59 0 2
0 0 7							
January, 1888.		Pur-	chased at	£145, less	scrap, £10.		
0 11 3	79 6 3	0 11 3	78 15 0	0 11 3	90 1 11	0 13 1	89 8 10
cost sheet.			12 0 0	0 1 10			
January, 1892.		Pur-	chased at	£115, less	scrap, £10.		
0 8 9	82 13 9	0 8 9	82 5 0	0 8 9	81 16 3	0 8 9	81 7 6
January, 1892.		Pur-	chased at	£60, less	scrap, £5.		
0 4 7	43 6 3	0 4 7	43 1 8	0 4 7	42 17 1	0 4 7	42 12 6
January, 1889.		Pur-	chased at	£80, less	scrap, £5.		
0 6 3	59 1 3	0 6 3	58 15 0	0 6 3	58 8 9	0 6 3	58 2 6

the like extent. Some which would be contained under class B would for many years be left untouched by improvements, whilst others in the same class would, perhaps, only a year or two after erection, become obsolete, and of little more value than scrap iron, and yet it is probable that all would continue in the list wherein they first appeared.

Taking all facts into consideration, the safest and best plan appears to be to deal with each machine separately, to fix its rate of depreciation at the time it is erected, and to permit no reduction of this rate without the sanction of the directors first obtained. Should an improved machine, of any of the kinds used in the works, at any time be placed upon the market, the manager must consider the effect it will have on the continued use of those under his control, must estimate the shortened period of time for which they may be kept at work under the new conditions, and must accelerate the rate of depreciation accordingly.

The rate should be based on the estimated life of the machine; thus, for an article which costs, fixed in place and ready for working, £120, it is assumed that it will, with reasonable care, last for twenty years, and at the end of that time be worth £10 for scrap material; then the annual amount to be written off will be £5 10s. When, however, repairs are effected to the machine which are in the nature of renewals of the worn-out portions of it, or improvements of some part, in either of which cases its working life receives a new lease, then the cost of such work must be added to the value standing in the schedule, and a new rate and length of depreciation calculated. The annexed example, which first appeared in an article by the writer in *Engineering*, on January 19th, 1894, will better explain the method of keeping the account which is here suggested.

This depreciation account will be prepared in separate schedules for each department of the works, and a total must be made at the foot each month, so as to show both the monthly amount of depreciation written off, and the present value of the buildings and machinery on the premises.

Interest.—It has already been stated that interest constitutes a difficult problem, which, in the case of estimates, had better be dealt with as a portion of the profit than estimated under establishment charges, except in the items of interest on machinery and tools, and on cost of land and buildings where these are the property of the

firm, and not rented from an outside landlord. In cost accounts, however, this evasion is no longer permissible. They must, in some form or other, contain all the expenditure of the firm allocated to each department, and interest is part of that expenditure. The first step to be taken is to ascertain the total interest to be paid during the month. This will include:—

Interest on partners' capital in private firms.

Interest on debentures in limited companies.

Interest on preference stock (though termed dividends) when this is a fixed rate, and not fluctuating with the profits of the company.

Interest on loans, on bills receivable or payable, and bank commission or interest.

The fixing of this total amount will require considerable care and ability on the part of the accountant, particularly if the bill transactions are numerous or complicated. The object sought to be attained is to debit to the various departments each month the proper share of the interest incurred during that month; whatever skill may be displayed in doing this, it is pretty certain that an adjusting debit or credit will be required at the close of the year or half year, but it should not be for a very large amount if proper precautions are taken. The interest account should be in the form given on page 222.

The first five columns are for the purpose of arriving at the due proportions which each department should bear, and, in fact, represent its capital. The first three columns can be obtained from the depreciation account, of which an example has already been given; the land is not there represented, but it will be included in the accounts of all companies holding a freehold, and in those possessing leasehold land, which, apart from the erections upon it, has a value in excess of the chief rent paid. The stock will be taken from the cost account form A, and will be the stock in hand at the commencement of the month.

There is a space at the foot of the account for "Work in progress." In an ordinary factory, where textile machinery, machine tools, electrical fittings, or millwright work, are the chief constructions, this will seldom be required; work of this kind, although under progress, is included in the stock held by the department. But there are other establishments where the work is of greater complexity, and where a portion, at least, of that in progress cannot be

SUMMARY OF INTEREST AND DEPRECIATION. JANUARY, 1898.

	Land.	Buildings.	Plant.	Stock.	Total.	Interest.	Depreciation.
Offices							
Stores							
Mould Loft							
Foundry, Iron							
" Brass.....							
Smithy							
Forge							
Steam Power.....							
Machine Shop							
Joiner's Shop.....							
Fitters.....							
Work in Progress, viz. ...							
.....							
.....							
.....							
Balance of Interest.....							

carried forward as departmental stock. Instances of this kind may frequently be found in shipbuilding, and one actual example will serve to illustrate the matter. It had reference to a composite vessel, with steel frames, and teak planking, the contract conditions for which were very stringently specified. The third instalment was payable when the beams were in place, three-quarter deck stringers and sheer strakes worked, and deck deals on the premises; the fourth when all the deck stringers and sheer strakes were worked, and all teak and other planking on the premises. With the exception of some unimportant and inexpensive work, these two instalments were qualified for, and applied for, in September, but in consequence of these trifling omissions less than half of each instalment was paid in October, and the balance not until the following March. By that time the fifth instalment had been served and certified for by the inspector, but the payment of the previous instalments having been delayed, this was in consequence kept back until June. Another case occurred in connection with the construction of a foreign railway. The contractors for the excavation and levelling of a large section had completed their work to the satisfaction of the superintending engineer, and, indeed, obtained his certificate for payment; but, in consequence of some dispute with the superior authorities respecting freight of materials, the money was withheld from them for some months. Now, in both these cases the contractors incurred a loss of interest. If they did not actually pay it for money borrowed (which would be the case with some firms under such circumstances) they lost the interest they would have received on investments, or on deposits in a bank. But it is evident that no department ought to bear the penalty of this interest. In the first case the delay was the result of yard, as distinct from departmental, management; in the second it arose from a dispute which in no way affected the actual work. In such cases as these no department should be saddled with interest on the work unpaid for, through its appearing in the stock carried forward under the head of "Work in progress." It should, when finished, be transferred to B sheets, and thus disappear from the departmental stock.

Indeed, it may be assumed that all establishments engaged on complicated structures must make provision of this kind for work completed in sections, but not paid for, or only partly paid for, until the whole equipment is

finished. Such sections of the work as are ready for delivery, or for fitting in place, will be transferred from the departments to B sheets, but unless they are taken into the estimate for apportionment of interest the remainder of the work will bear an undue proportion of it, and the several shops be debited with a charge which is purely and simply the result of financial arrangements. The charge will, in general, be carried direct to the C sheets, as a difficulty may arise in defining the particular portions of the contract which are properly and justly subject to it.

The last item on the summary is "Balance of interest." This is to cover unemployed capital on which interest has to be paid to shareholders, debenture holders, or, in case of private firms, to one or more of the partners themselves. The charge incurred on such capital increases the cost of work throughout the yard, just as an increased price for gas or water would, but no single department can properly be charged with it. The burden is a general one, which should be shared by all, and the amount must be transferred to the management sheet, thence to be apportioned over the departments with the rest of the management charges. The amount of unemployed capital must be inserted in the total column.

The total amount of interest for the month has thus been determined, and the total column will give the items over which it has to be proportionally distributed. From the column "Interest" the charges will be transferred to the several cost accounts.

The last column, "Depreciation," is merely inserted to afford a convenient summary of those charges, collected from the plant and depreciation accounts, of which an example has been given. At the end of any financial period the amount of depreciation appearing in the trading account should be the total of these monthly summaries during such period.

Later Departmental Sheets.—We are now in a position to consider the later departmental sheets: those concerning the actual constructive work, and which are not, except in some exceptional instances, cleared by transfer to any further or other department. The exceptions are in the few cases where one department does work which strictly ought to be done by another, or where, for instance, a blacksmith or machineman is called upon to remedy some

blunder of the fitter. In such case the work done really belongs to the fitting department, and is a portion of the cost, directly or indirectly, incurred in that shop; in others it properly belongs to the department doing the work, and is, therefore, transferred from it direct to the B sheet.

Sheet A.—An example of the fitters' sheet (which is only supposed to give a few items, and not all passing through the shop for the month) will explain the method of making the entries and transfers in this portion of the cost accounts (pp. 226, 227).

The stock brought forward on the 1st January is sum of the last items appearing on the credit side of the December account; it includes any unused and unappropriated stores on hand in charge of the foreman, as well as any uncompleted work in progress. If it is more convenient to the cost accountant, the details can be given in the new account, but it is entirely a matter of convenience; it must be remembered that he has the former account to refer to. The purchases are only those items specially ordered for a specific contract; as in this case, pumps for use in connection with dock gates, and the particulars will be obtained from the invoice book. On reference to the form of invoice book, already given, it will be noticed that a column marked "Process" is introduced, which is additional to those found in most invoice books. The majority of the invoices will be for materials for delivery into stores, and re-issue from there, and the word "Stores" will be written opposite them in this process column. In those cases where materials are specially ordered for a particular contract, and pass immediately on receipt into the custody of a foreman of department, and not through the stores, the title or number of such contract will be entered in this column thus: "Order 5713," or "Milford Dock Gates." The invoice clerk will seldom be able, nor should he ever be permitted, to do more than this. The cost accountant must supply the title or symbol of the process, and though this may sometimes entail a little enquiry and thought upon his part, it is well within his duties. When he degenerates into a mere automaton, capable of movement indeed but only in one well-defined groove, he becomes worthless to his employers.

The wages are a very simple matter; they are the amounts obtained from the analytical abstract of wages, stated under the head of the different portions of the work.

SHEET A.

FITTERS.

	Quantities.	Materials and Expense.	Salaries and Wages.	Trade Debits.
TO STOCK, JANUARY 1ST, 1898.		17 6 7	31 0 2	
PURCHASES—				
Gwynne & Co.—Pumps—5713—D.G.A.—15		112 0 0		
WAGES—				
5713—D.G.A. —15.....			60 5 6	
” — ” —12.....			13 1 4	
5718—F.P.L. — 1.....			31 6 8	
5719—M.M.B.— 4.....			18 1 6	
Piant—S.C.C.—10.....			2 1 0	
TRANSFERS FROM DEPARTMENTS—PROCESS—				
Stores—5713—D.G.A.—15.....		2 1 6		
5718—F.P.L.— 1.....		2 8 7		
5719—M.M.B.— 4.....		1 6 4		
TRANSFERS FROM DEPARTMENTS—ESTABLISHMENT CHARGES—				
Management charges		3 5 10	16 5 2	
Motive Power.....		20 1 4	2 5 6	
Cartage Department		10 6	12 2	
Drawing Office		1 1 0	7 0 6	
ESTIMATED CHARGES—				
N. B. Railway—Freight—5713—D.G.A.—15		17 6 7		
INTEREST		5 6 2		
DEPRECIATION		3 1 4		
		185 15 9	181 19 6	

Transfers from Departments.—The transfers from departments are divided into two parts, “Process” and “Establishment charges.” The titles of the departments, or anterior A sheets which come under the same category, should always be stated. In this example the process charges are all from the stores department, and the various sections of work affected are properly and conveniently stated, just as they are under the head of wages. As already explained, there will be very few inter-departmental transfers in an ordinary engineering factory; each department’s costs must be made up separately in the A sheets, and as the several sections of work are completed the cost must be transferred thence to the B sheets. Occasionally some job will be done by one department for another, either to assist the latter in its own proper work on some particular job, or render help in some renewal work for the shop. In such case the

FITTERS.

SHEET A.

	Quantities.	Materials and Expenses.	Salaries and Wages.	Trade Credits.
BY ESTIMATED CHARGES.		17 6 7		
TRANSFERS TO SHEETS—				
B Sheet—5713—D. G. A.—12		3 9 10	15 16 1	
„ 5718—F. P. L.—1		10 16 1	37 18 1	
„ 5719—M. M. B.—4		6 2 7	21 17 3	
TRANSFERS TO PLANT SHEETS—				
S.C.C.—10		10 9	2 9 8	
STOCK JANUARY 31ST, 1898.				
5713—D.G.A.—15—in progress.....		130 3 4	103 18 5	
„ „ „ estimated...		17 6 7		
		185 15 9	181 19 6	

amount will appear on the credit side of the account of the working department, and on the debit side of that of the worked for department. With such engineering works as building, railway, canal, and dock constructions these transfers may, however, be more numerous, and will then demand considerable attention from the accountant.

The establishment charges are generally of a simple character. A sample has been given of the sheet for management expenses, and the others will follow the same course.

Estimated Charges.—These are estimates for goods consumed but invoices for which have not been received. In the present instance it will be observed that the stock on January 1st includes, under the head of materials and expenses, an item of £17 6s. 7d., and that on the other side of the account this amount is placed to the credit of the department. Lower down the same item will be seen

again brought to debit as estimated for freight on goods for order No. 5,713, item of work D. G. A. 15, the invoice being still wanting from the railway company at the end of January. The reason for these entries will be apparent to the book-keeper. Whilst it is necessary to guard against dangers of omission by entering immediately to the debit of a job any goods used for it by an estimated charge, if an invoice has not been received from the suppliers, this must necessarily be regarded as a temporary expedient to be corrected by the permanent debit through the stores issued book or invoice book when the invoice is received. It is therefore necessary to credit the department with any estimated charges of the previous month, and if any of these are still in abeyance to re-debit them as estimated for the current month.

The debits for interest and depreciation are obtained from the account of which a specimen has been previously given.

Credit Transfers to Sheets.—The total debits to the fitter's department having been arrived at, the amount has now to be cleared by transfer to the second series of accounts, the B sheets, of all completed work, and to the stock in hand of work still in progress. This, of course, requires the distribution of establishment charges over the work executed in proportion to the direct wages paid.

Materials and Expenses.—The establishment charges in this column (including interest and depreciation) amount to £33 6s. 2d. The direct wages are £124 16s. Taking these proportions we arrive at the following results:—

	Materials and Expenses.	Add Proportion of Establish- ment Charges.	Amount to Credit.
	£ s. d.	£ s. d.	£ s. d.
5713.—D.G.A.—15	114 1 6	16 1 10	130 3 4
5713.—D.G.A.—12 .....	.....	3 9 10	3 9 10
5718.—F.P.L.—1	2 8 7	8 7 6	10 16 1
5719.—M.M.B.—4	1 6 4	4 16 3	6 2 7
Plant.—S.C.C.—10 .....	.....	0 10 9	0 10 9

The first item is work still unfinished, and is therefore carried to stock at January 31 as work in progress. The

next three items are finished so far as the fitters are concerned, and the amounts are therefore included under transfers to sheets, being placed to the debit of the B accounts for the several jobs by the cost accountant. The last item is for repairs, in the nature of addition or renewal, to a machine belonging to the firm, and is transferred to the plant account in the manner already shown. These transfers, with adjusting entries for estimated charges, will exactly balance the debits to the department for materials and expenses.

Salaries and Wages.—On reference to the debit side of the account it will be seen that the direct wages amount to £124 16s., the establishment charges to £26 3s. 4d., whilst £31 0s. 2d. was brought forward from the previous month under the head of stock. This latter amount was for work in progress on order 5713—D.G.A.—15, which, it will be seen, was still unfinished on the 31st January, and is therefore again carried forward at that date as stock. It must, however, be observed that as the direct wages on this portion of work bore their due proportion of establishment charges for December, nothing more is added to them on that account for January; *the establishment charges for any one month are distributed over the direct wages for that month, and over no other.* The amounts to be credited will therefore be:—

	Stock.	Direct Wages.	Proportion of Establishment Charges.	Total.
5713—D.G.A.—15 ...	31 0 2	60 5 6	12 12 9	103 18 5
„ „ 12	13 1 4	2 14 9	15 16 1
5718—F.P.L.—1	31 6 8	6 11 5	37 18 1
5719—M.M.B.—4	18 1 6	3 15 9	21 17 3
Plant S.C.C.—10	2 1 0	8 8	2 9 8

These, it will be seen, are the amounts which appear on the credit side of the account, and which exactly balance the debits to it.

CHAPTER XVII.

COST ACCOUNTS (*continued*).

Sheet B.—The A sheets are the foundation for the cost accounts; the debits to the various departments are there entered, and on the opposite, or credit, side of the sheet apportioned to the various items of work undertaken during the month or other period under consideration. But they do not conclude the process. It will be seen, from the example previously given, that portions of three orders have been completed, so far as the department of fitters is concerned, and transferred from a charge against that department to a charge against some other department or thing appearing on a B sheet. Now, if we took up any other departmental sheet for the same month, say, for instance, that relating to the turners, or blacksmiths, we should find charges there against orders 5713—D.G.A.—12; 5718—F.P.L.—1, &c., &c. We want to know the total cost of the first item or detail, that is, of the frame of the machine F.P.L., and not merely the sums, in material and labour, expended on it in the fitting shop. As the A sheet has been a summary and subsequent analytical transfer of numerous items appearing in previous books, so the B sheet must be a summary of items from the A sheets, and finally a transfer of them to a further evolved form of summary.

Form of B Sheet.—The form of the B sheet will differ slightly from that previously adopted, inasmuch as the record may extend over several months instead of one. It is therefore necessary to provide a column for the date. The annexed example will show what is required.

The items of “purchases” are only for such stores or materials as are obtained expressly for some particular work on which no further labour has to be expended in the yard, and which are, therefore, charged in the invoice book (column “process”) direct to that work, and not to some department for it. Although in the example they are shown each month, such purchases will be exceptional, and will hardly arise in an ordinary machine tool or mill fitting shop.

The transfers from departments will be sufficiently understood from the explanations already given under the head of A sheets. In general there will only be one transfer from each department, as any unfinished job will be carried forward in the departmental accounts as "work in progress," and only transferred when completed. When, however, a number of articles of like kind are made for the contract, such being completed in different lots in different months, the transfers may extend over several months, as is assumed in the example.

Scrap Material.—It is desirable to credit scrap material to the exact item of work on which it is made, whenever this can be done, but it must be admitted that there is great difficulty in practically adjusting these credits. When it is possible they should be credited in the A sheets, so as to reduce the cost in that department of any one or more items from which they arise. Where the item is known, but the departments contributing the scrap cannot be determined, the credit must be given in the B sheet for such known item, in the manner shown in the last example. Where only the order or contract is known, but not the particular item or items, the scrap must be credited in the C sheet. After this process of exhaustion there will still remain scrap material in the yard which cannot be allocated either to any contract or any portion of a contract. Such remaining scrap must be credited to one of the establishment sheets, such as management expenses, and thus reduce the debit of such charges to the various constructive departments of the yard from which the scrap arises.

Balance of B Sheets.—The balance, that is, the cost after deduction of the credit for scrap material, will only be transferred to the final summary, the C sheet, after all work on the item has been completed. So long as there is anything to do to complete the 14th detail of D.G.A., Order 5713, the B sheet must be left unclosed, even though work may be suspended on it for many months. The purpose of this and other like accounts is to ascertain the exact cost of the special item, part, or detail, to which they refer, and this cannot be done unless they are kept open until the work on such items is actually completed.

C, or Contract Summary Sheet.—It is part of the essence of this method of cost accounts that, as work is completed in certain stages, it should be transferred from

a more simple form of account to a more evolved one, that it should be synthetical in operation. Thus, from the first set we ascertain the cost of work performed in the various departments during the month, and the particular items on which it has been expended. In the second set we collect the costs of these various departments into groups, each of which groups is one of the items or details in a contract or order. Finally, we have to collect all the groups belonging to one contract or order into an account, which will show the total actual cost of it to the firm. The annexed form (which appeared in *Engineering* for February 16th, 1894) is the means by which this final concentration is effected. The items taken are some of those for a war vessel, but the form will equally apply for any other form of engineering construction.

Arrangement of Debits.—The account which will be most frequently referred to for preparation and checking of future estimates, for comparison with later costs of machines of the same class, and for other similar purposes, will be the third, or C account. It is therefore important to exercise considerable care in framing it, so that the debit side may contain all the details for which B accounts are opened; these must be at least as numerous as the heads and sub-heads contained in the estimates; in most cases there will be more such lines in the final cost account than in the original estimate. Where an estimate line is divided into two or more in the C account the latter should be placed together, and connected with a bracket to indicate that they refer to one item in the estimate.

After the general debits are finished interest is entered. This is for interest on overdue instalments, as previously explained. Where it is practicable the interest must be charged in the B account, on the general principle that all charges and variations should be entered at the earliest possible stage; but there are many cases where the interest arising from causes affecting either the whole contract or so large a portion of it as to render it impossible to charge it in any other than the final account. In this interest entry any charges arising on overdue or renewed bills, or on payments made in stock or shares which are not yet earning dividends, must also be adjusted.

Credits.—The credit side of the account contains the eight instalments by which the ship is paid for, and which

SHEET C.

Dr.

H. M. S.

	Materials and Expenses.	Salaries and Wages.	Trade Debits.
To Laying Blocks.....			
„ Keel, Stem, and Sternpost.			
„ Frames			
„ Deck Beams			
„ Bulkheads			
„ Watertight Doors			
„ Magazine			
„ Spirit Room.....			
„ Cabin Fittings.....			
„ Laying Decks			
„ Hammock Nettings			
„ Davits			
„ Steam Steering Gear, &c...			
„ Interest.....			
Add Materials			
To Balance— <i>Profit</i>			

SHEET C.

ACORN.

Cr.

	Materials and Expenses.	Salaries and Wages.	Trade Credits.
By First Instalment			
„ Second „			
„ Third „			
„ Fourth „			
„ Fifth „			
„ Sixth „			
„ Seventh „			
„ Eighth & Last Instalment.			
„ Scrap Material			
Add Materials (viz., Instalments for Engines and Boilers)			
By Balance— <i>Loss</i>			

are entered there from the cash book as, and when, the money is received from the purchasers. There is also an entry in the example on both debit and credit side of the account, "Add materials," which at first may appear a little perplexing, but which entry is sometimes necessary for the proper completion of the record. For instance, the tender for a ship, more particularly for the British or a foreign admiralty, has frequently to be made in some such form as this:—

For the hull and equipment complete of steam-	
ship_____	
as described in the fore-	
going specification	£.....
For the engines, boilers, and machinery of the ship,	
to be constructed by Messrs._____	
as described in the machinery specifica-	
tion	£.....

In such case the several instalments received on account of the engines and machinery will be entered on the credit side of the account in the column for materials and expenses, and these credits must be balanced by an entry on the opposite side, "For materials," of the amount paid to the machinery contractors.

Closing of C Account.—In this account the item of profit or loss appears for the first time. It will be seen from the nature of the previous accounts that it cannot enter into them, as they are merely entries and adjustments of expenditure transferred from account to account until they finally appear in the C sheet. Here we have a summary, on the one side, of all the debits and payments incurred on account of the contract; and on the other, all amounts received for it, either by way of payments on account, instalments, or for sale of waste material. The total of the column, materials and expenses, must be brought into that for salaries and wages on both sides of the account, and the difference between these debits and credits will be the gain or loss on the contract.

This, the C, portion of the cost accounts cannot be closed until the contract or order, or job, is completed; that is to say, until all the work has been finished and charged, delivery effected, all trials completed, and also all payments made. It is hardly safe to close until any bills of exchange given in payment have run off, in case these

are not met as they fall due, and have to be renewed, and this would require a further adjustment of the charge for interest.

Quantities in Cost Accounts.—It will be observed that in the A and B accounts a column is inserted for “quantities,” which is allowed to fall out of the C account. The reason for this omission is that all the several sections of work are completed before they are entered in the latter account, and there is no utility in making an entry which can only signify such completion. But in the two former accounts it is necessary that the manager should have information of the amount of work done, as well as the expenditure upon it, in order that he may be able to judge of the progress of the cost. Now, “quantity,” in the cost account sense, need not necessarily be weight or dimensions of materials: it may be represented by a proportion of the total work to be done in the A sheet by the department in question, and in the B sheet by the whole of the departments, on the particular detail or job. After careful consideration, it appears impossible to suggest any general rule which will apply to all cases; the object sought will, under some circumstances, be best obtained by weight or measurement, whilst in others the proportional estimate will be more appropriate; the immediate conditions must determine the usage. But it is the manager, that is, the engineer, who requires the information, and therefore he, and not the accountant or clerk, must decide what form or forms it shall take. When the form, whether weight, cubic contents, or proportion, has been decided, the actual figures must be obtained by the cost accountant from the foremen or other technical officers, and not inserted in the sheets from his own guesses.

Trade Debits and Credits.—Columns for trade debits and trade credits will be found in all the cost accounts, A, B, or C, of which examples have been given, but the method of filling up these columns, and the service they can render to the engineer, have not been considered. So far as the accounts have yet been dealt with, it is evident that only actual figures of wages, purchases, and expenses are dealt with; that when estimated accounts are used in any month, it is only for a temporary purpose, and with a view to correction in the following month by substitution of the actual figures. A profit or loss is shown on any particular contract, but none on a department, nor on any

particular section or detail of a contract. It is, however, at times essential that the working of a department should be gauged in terms of money, and judged by the profit made, and not merely by the extent of work turned out.

It is true that many firms open departmental accounts in their commercial ledgers, and endeavour to turn these into miniature trading accounts by debiting them with proportions, more or less arbitrary, of the establishment charges, and crediting them with assumed values (not exceeding in the total the selling prices) of the work done in each department. The cost accounts furnish more ready and accurate means than this of obtaining the information desired, whilst particulars are left open in the commercial books which would otherwise be lost sight of.

Trade Debits.—The object is to ascertain the profit of a department, considered as a portion of the firm's establishment it is true, but working independently of the other manufacturing shops, and obtaining such prices for completed work as would be paid for it to outside vendors, or would be charged to other constructors if it were done for them.

The two columns, "Materials and Expenses" and "Salaries and Wages," are amalgamated in the trade debits and credits. The stock brought forward on the 1st January will be the sum of the stock on hand shown on the credit side of the third column of the previous account at 31st December. It will generally be the same as in the cost accounts proper; if the stock consists solely of materials on hand it must undoubtedly be so; if work in progress is included it should usually be taken at actual cost, as in the previous columns, since profit, or estimated profit, accrues on completion of the work. "Purchases, Wages, and Transfers from Departments—Process," will be the same as in the former columns. They are the exact payments of money for those services. It has already been said that transfers from one constructive department to another will seldom arise; when they do occur they will form an exception to the foregoing rule, as the blacksmiths of the firm are entitled to the same charges when working for the fitting shop as when working for any outside customer. The "Transfers from Departments—Establishment charges" will in most instances be the sum of the two previous columns. It is quite clear that no profits should

be assumed on charges for management, motive power, or drawing office, but cartage is really governed by the same consideration as the blacksmiths already referred to. The charges for use of horses and carts to the fitting or machine shops should be the same as would be paid to an outside carter, and this will yield a profit if the stables are properly managed. Estimated charges, interest, and depreciation will be the same as in the ordinary cost accounts. It will therefore be seen that on the debit side of the sheet the differences between the sum of the first two and the third columns are not very numerous, and do not involve any great amount of labour.

Trade Credits.—The credit side of the account will not merely demand more attention from the cost accountant than the debit side, but will also require more correspondence with, and information from, the technical officers. The estimated charges are merely an adjusting entry, and do not need comment. The “Transfers to Sheets,” and “Transfers to Plant Sheets,” will, however, be based on the actual market charges for such work, and not on the cost of materials, wages, and expenses. As charges so estimated are not for finished items of work, or completed machines, but only for the labour, &c., expended by the fitters in their contribution to such items, it will be necessary to consult the technical officers as to the value of the contribution; that is, as to the amount they would, under ordinary circumstances, charge to an outside firm for it, or which they would pay to such firm to do the work if it could not be executed in the yard. Thus, in the case of a heavy forging, the point for consideration, so far as the trade credit is concerned, is not the cost in direct and indirect charges, but the amount at which it would be invoiced to a customer of the firm, or which would have been charged for it had it been made at a Staffordshire, Mersey, or Clyde forge. It is a case of competition, the department against other manufacturers, and the department is entitled to all the benefit of these competitive prices, but to no more. The difference between the two sides will be the profit or loss of the department, computed on an ordinary commercial basis.

The transfers will follow precisely the same course as in the original cost accounts, and it will therefore be seen that neither profit nor loss will arise in the B sheets. When we come to the C sheets the profit will probably be

a small one, since it has already been absorbed in the working of the departments; indeed, the balance may, in many cases, be there turned into a loss. However, if the profits and losses of the various departments, and of the completed contract (C account) are extracted, the result will be exactly the same as that shown in the second column of the C account, that is, assuming the clerical work to be done correctly.

And now the engineering manager will have before him, in very convenient and vivid form, both the actual cost of work in the yard, under minute sub-divisions, and those same costs compared with the prices he would have to pay outside firms, or which he could obtain from them for the same work. He will be able, at the same time, to see which departments are profitable to him, and which, if any, require overhauling and reorganisation.

Transfers to Plant Sheets.—For the purposes of “trade credits” it is correct to allow a profit on work done in making or erecting new plant for the firm’s own use; without such profit it would be impossible to correctly gauge the earning capacity of the department. But in the ordinary books of the firm, that is, in the accounts on which the dividends of the company or the partners’ withdrawals are based, it is undoubtedly the soundest finance to reckon no profit, but to charge only actual cost of material, labour, and proportional establishment charges on new buildings, machinery, or other erections, and on renewals for the firm’s own use.

Recapitulation.—Having now arrived at the conclusion of the three-fold form of cost accounts, it is convenient to recall the ground passed over. Although theoretically the manager should be the originator of all workshop movements, he could only practically become so through proper delegation of duties, and the drawing office appears the most convenient medium through which orders for the works can pass. For goods to be supplied from stock, a short order to the warehouseman, giving sufficient particulars of the article demanded, and of forwarding instructions, will be prepared in the general office and merely recorded in the drawing office. But orders from stock do not form the chief portion of the work in the general engineering factory. In such an establishment the transactions are chiefly specific orders for special machines, &c., even when such machines are of standard patterns.

For the purpose of an orderly and adequate system of arranging work to be performed in the shop, the drawing office order book is an absolute necessity. Part of the particulars for this order book will be obtained from papers furnished to the draughtsman from the general office, but those more important portions which have reference to tracings received or sent away, instructions to the shops, and preparation and issue of shop drawings will arise within the drawing office itself. This book, therefore, if properly kept, will show what information and instructions have been furnished by the technical department to the works at any particular date, and what are still required to be supplied. Shop orders have to be supplied to the various foremen which must advise them of the work to be done, and of any special conditions affecting it. Copies of these orders will also be sent to the pattern maker, storekeeper, and warehouseman, and will enable them to proceed with any portion of the work affecting their departments without causing them to delay the workshops. Alterations have occasionally to be made in these shop orders, and supplementary instructions have to be issued, which may be done in one of three ways. A reference to the shop order will show that the most important portion of it is contained under the head of drawing numbers, such drawings being the real instructions upon which the working portion of the establishment will proceed, and as many of them may be used for several orders, it is necessary that a proper record should be kept of all drawings prepared or received by the firm. This register should contain the initial number of the drawing, which is really the number of the general arrangement plan, and it should also contain the supplementary letters or numbers by which the shop or detail drawings and the patterns are distinguished. An alternate form of register is suggested which presents some advantages over the usual one: simple letters being substituted for the progressive drawing number of the former method. It is, indeed, an adaptation of the symbol system of the Ferracute Company of New Jersey, and in the majority of cases will shorten the clerical entries in the wages sheets and stores issue book. Whatever form is, however, adopted an adequate index should be used with it, and provision made for dealing with drawings for special contracts of abnormal size. In course of time it will be found necessary to make alterations in both standard drawings and patterns, and

these alterations must be so noted from drawing to drawing, or pattern to pattern, as to form a history of the facts. In preparing drawings for the shops, it must be remembered that they are to contain all the draughtsmen's knowledge of the specification, and they must therefore be very complete and marked with all dimensions. A record book of tracings sent away and a shop drawings diary must be kept, and careful provision made for the filing of drawings.

When we come to the works manager, it is found desirable that an order book should be kept in his office so that he may readily ascertain the executive conditions of work in progress. The institution of conferences will also assist him in preventing delays through imperfect office management, and facilitate inter-departmental arrangements. But office arrangements are more easy to grapple with than the management of workmen, and the problem of the present day is the stimulation of their productive energies. This has been attempted in England by the system of profit-sharing, but it is in America that the most strenuous efforts have been made to solve the problem. In one case it is attempted by committees and sub-committees of foremen and sub-foremen, with generous awards to workpeople for any suggestions they make. In another it is by the adoption of fixed piecework rates, which insure the workmen against the danger of lowering prices when he could, by his own exertions and ability, increase his weekly earnings. But the third method is worthy of the most careful consideration, because it has the effect of automatically grading the men, by increasing their emoluments in proportion to their energies and ability, and not by decreasing them as they fall short of a fixed standard of work. The great object of the works manager should be, however, to study all methods, and adopt whichever is best suited to the special conditions of his firm, and of the workpeople with whom he is immediately concerned.

The next points considered are the admission of workmen, the recording of their time, and the preparation of the wages books to facilitate financial and cost-book records. An abstract of wages must be prepared. In like manner the issue of materials by the storekeeper must be systematised so that the ultimate charge may be made against proper contracts or details of contracts. For this purpose a proper stores issue book must be kept, from

which the store ledger may be posted, and a monthly return of stores issued prepared for the accountant and the cost accountant.

The arrangements and records hitherto referred to are necessary in an engineering works where only ordinary finance books of account are kept, but it is needful that the engineer of the present day should have, in the form of detailed cost accounts, more minute information than he could obtain from his ordinary books. Those recommended are of a threefold character. The first of such divisions form departmental accounts, but some of those departmental accounts, such as management charges, motive power, and drawing office expenses, are divisible charges which have to be transferred to the later departments, to the blacksmiths, moulders, and fitters, &c., in proportion to the wages expended therein. It is also necessary, in order to arrive at accurate costs of details, that depreciation and interest should be charged in the A accounts each month, so that the items of work executed during that month may each bear their proper proportion. If depreciation is calculated by percentage on the capital expended, then the buildings and plant should be divided into several classes, and the percentage adjusted to their varying rates of wear. But it is suggested that a preferable method is to make very complete schedules of the buildings and plant, and write off depreciation on each individual building or machine, calculated on the estimated life of it. The interest also must be divided over the several departments, and provision made for interest on work in progress and unemployed capital. As work on any detail or machine, or other order, is complete in any department, the cost of it, inclusive of the proportionate establishment charges, is transferred from the A to the B sheet, so that the latter forms a summary of the cost of each item or portion of the machine. Finally, as the various sections of the machine are complete, the B sheets are transferred to the C sheets, which form profit and loss summaries of each particular order or contract. We have thus in this threefold division of the cost accounts the following particulars:—

Departmental costs.

Costs of portions of machines.

Costs of completed machines.

For the purpose of ascertaining the value to the firm of any particular department in the works, as compared

with work purchased from outside producers, columns are added to the several cost accounts for trade debits and credit. In these columns the work is valued at such prices as would be charged for it to an outside purchaser, or paid to an outside manufacturer, and so the profit or loss of the department, working as a separate and independent concern, is arrived at. The figures in these columns are merely computations ; but they are computations framed on such a method that the final result in the C sheet will be the same as that arrived at by the previous method of costing.

CHAPTER XVIII.

MONTHLY PROFIT AND LOSS ACCOUNT. CLAIMS AND LOOSE TOOLS.

Monthly Profit and Loss Account.—It will probably occur to bookkeepers that the cost accounts, of which we have given examples, are not prepared on the double entry system, and therefore do not, within themselves, prove their own correctness. It has already been explained that, for specific reasons, they are not interlocked with, and made part of, the financial books of the firm, and it would be easy to show that the labour involved in double entry would be much greater than the advantage obtained, although at the same time such a system might be introduced without in any way departing from the present principle of working the cost accounts distinct from, but parallel with, the ordinary business accounts. This does not mean, however, that there need be no plan adopted for proving the correctness of the cost accountant's work. Such means can be adopted, and they will, at the same time, afford other advantages in the conduct of the business. For this purpose the accountant should prepare each month an approximate profit and loss account. The form adopted is practically that of an ordinary trading account, and an example is hereto appended. On the debit side of the account the first entry is for stock on hand at the commencement of the month. This will include not only the stock in the stores, but also any which may be in charge of the various foremen, and any work which might have been estimated in progress in the shop at the end of the previous month, and in that month taken into departmental stock. The purchases will be the total amount shown in the invoice book for the month. The salaries and wages will be obtained respectively from the cash book or salary book, and the wages book. Carriage and cartage will be obtained from the carriage invoice book, if a separate one is used; but if carriage

invoices are passed through the general invoice book, then the amount will appear in the general item of purchases. The sundry expenses will be got from the cash book, or petty cash book. Of course the competent bookkeeper will readily fall into the method of using the nominal accounts of his ledger so as to facilitate this portion of the work. The interest and depreciation are got from the accounts already referred to as prepared for the cost sheets. It will be seen that interest is thus debited monthly, although it would probably be paid each six months, and therefore care must be taken not to debit the amount again from the cash book to these approximate profit and loss accounts.

The other estimated charges follow the same rule as interest and depreciation, that is, they must be debited in proportional monthly parts, and care must be taken that they are not included again when the official debit is passed to the invoice book or the payment is entered in the cash book. In the cost accounts they will appear in one of the preliminary A sheets—either one headed rents, taxes, insurances, &c., or in management expenses—and be thence divided over the several departments.

On the credit side of the account the first entry is for sales, the amount of which will be obtained from the day-book, or from any record kept which is equivalent to, and in the nature of, a day book. The additions to plant are the amounts added to the value of the plant during the month, obtained from the cost accounts, and which appear in the several schedules of buildings and plant. If these additions to plant are passed through the day book, as in many firms they are, then the amount of them must be deducted from the day book total, so as to prevent duplicate credit being taken in the first item of sales. The estimated charges for work in progress must include all such work, no matter what its condition or where it appears in the A, B, or C sheets, if the debit for it to the customer has not been passed through the day book so as to be included in the item of sales. It is desirable to state these estimated charges of work in progress under the heads of the several contracts, but it is not absolutely necessary for mere purposes of account; if only balancing is required one line would be sufficient. It will further be noticed that the stock includes, not only materials in the stores, but also those in the fitters', blacksmiths', and other shops, the values of which can be obtained from the cost accounts.

When this account has been finished, the profit or loss shown in it should agree with the total profits or losses shown in the cost accounts. If this agreement is not arrived at some error must have occurred in working, for which search must be made until it is discovered.

One or two points deserve a little attention, although they are more desirable for facilitating the easy arrangement of work, than absolutely necessary for the working of the commercial system.

Works Instruction Book.—In most works it will be convenient to enter instructions of a general character in a foolscap book, instead of issuing separate memorandums, exactly the same in wording, to each of the officers. The book should have a marginal space down the right-hand side for the initials of the several parties reading the orders. This is the method followed in the British army and navy for brigade, regimental, and ships' orders, and is found to work well.

Shop-to-Shop Orders.—It is evident that no orders from one shop to another are necessary with respect to ordinary contracts, or ordinary work on stock goods. Instructions are issued by the drawing office to each foreman simultaneously, and there is therefore no necessity, nor excuse, for one endeavouring to instruct another. Unity of action is secured through the weekly conferences. But work may be required in one shop on behalf of another which does not arise strictly out of the drawing office instructions, such as repairs of some plant or building, or remedying defects arising through bad workmanship in the requisitioning shop. In such cases it is necessary that both foremen should relatively control the expenditure; that is, the requisitioning foreman should sanction it in proper form, and the executing foreman should see that it is debited to the proper department. There is no necessity to multiply forms for this purpose. The order book used for drawing materials from the stores can be used also for the purpose. The order should state the account to which the work has to be charged, as "Repairs of No. 7 lathe, machine shop," or "Fitting shop, 5,713—D. G. A—12," the latter being an instance where the work is done for, or to repair some of the defects of, the fitters.

Claims against Railway Companies, &c.—A little difficulty arises in connection with claims against railway

companies and other carriers, and also against manufacturers for inferior goods, or on goods not complying with the conditions of the specification. They are always open to dispute, and even when admitted have frequently to be settled for less than the amounts first claimed. It therefore appears unwise to take credit for them, especially if they amount to a large sum, until such time as they are actually paid. Instead of debiting them to the Great Midland Railway, the Northern Central Railway, or Alfred Sommers and Co. Limited, in their respective personal accounts in the general ledger, the better plan appears to be to keep a claims book, and enter in it each claim as it is made. When it is paid the cash received will appear on the debit side of the cash book, and from there be posted to the credit of the account entitled to receive it, which in most instances will be the stores account. If the claims book be treated merely as a memorandum book, the transaction will only come into the accounts of the firm when the cash has been received, and there is no possibility of its being recalled.

In those exceptional cases where the amount claimed is a heavy one, and one which should be brought under the notice of the proprietors or shareholders, it may be specially included in the balance sheet as a "claim pending." If this is done, a like allowance must be made in summarising the profits collected from the cost accounts.

Form of Claims Book.—The book may either be in ordinary ledger form, or may be specially ruled for the purpose. We have seen a very useful record kept in the form on page 250.

Loose Tools.—A still greater difficulty arises in connection with loose tools, and it is almost impossible to evade it by means of memorandum entries. The tools are debited to the storekeeper when purchased, and afterwards included in his return of stores issued; they must therefore appear, when in use, in the departmental stocks. The depreciation on them is very great; they not only suffer from legitimate wear and tear, but are frequently lost, more particularly when they are used on repair work, or are taken by the men to execute jobs and new erections away from the yard. Some of them are very valuable, and are really machine tools, but portable, and employed as portable machines. Again, there is some difficulty in distinguishing between fixed and loose tools, arising not

CLAIMS BOOK.

Date.	Letter Book.	Claim Against.	Particulars.	Amount Claimed.		Particulars of Settlement.	Amount Settled for.		Date.
1897.				\$	c.		\$	c.	
April 13	3/47	Baltimore and Ohio Railway	Loss of Coal in transit from Cardiff to Puebla, per s.s. Descartes, transhipped at New Orleans to the B. and O. Railway, on through Bill of Lading.....	500	00	Admitted for payment on 16th January, 1898. Paid	500	00	13 Feb.

merely through their merging one into another, but also through the varying practice as to their user. Whilst there would be no doubt in any works as to the respecting classifications of a screw cutting lathe and a cold chisel, the determination of portable forges would not be quite so clear; in some works they might be moved from spot to spot in the smith's shop, but never out of it, whilst in others they would be constantly passing outside the yard through the gates. Again, whilst a centrifugal or wall pump would undoubtedly be placed in the schedule of buildings and plant, as being secured to the premises, it is by no means so evident what should be done with a pulsometer steam pump, which may be employed at many places outside the factory.

The constant additions made to the loose tools in use by issues from the stores further complicate the matter. When a factory is once fully equipped, new machines and additional fixed appliances will only be required at intervals, whereas new loose tools will be issued almost daily.

Electrically-driven Tools.—The development of electricity as a motive power has conduced to many mobile tools, so operated, being substituted for machines fixed to the premises, and there appears strong indication that such substitution will greatly increase in the future. Mon. F. von Kodolitsch has introduced many of them in the works of the Austrian Lloyd Steam Navigation Company, at Trieste, and in a descriptive paper in *Cassier's Magazine* shows the advantages in working the shipyard which have been derived from the change. But the tools he refers to really partake, commercially, more of the character of permanent plant than of loose tools. Thus there are electric boring machines of various types, bolt-hole reaming machines, electric punches, and machines for cutting keyways; electrically-driven tube expanders, electric stacking cranes, winches, and fans; electric pumping outfits, cold saws for cutting castings, cylinder boring machines, lifts, and capstans. It is evidently wrong to speak of such articles as these as "loose tools," although they are not fixed to any specific platform or bed; they are just as much part of the "plant" of the establishment as one of the old-fashioned, immovable punching and shearing machines would be. There is a further reason for dealing with electrically-driven tools in the schedule of

plant and buildings, where each is separately recorded, and treated on its own individual merits, than in one of the accumulative schedules of tools, which are depreciated by an average percentage. M. von Kodolitsch anticipates still further extensions in this field of electrical activity, but he adds that the shape these extensions shall take can often be decided [only] by the engineer himself, as much depends upon special conditions and circumstances. It is, therefore, evident that for some time to come there will be considerable danger of the special depreciation which arises from new inventions, and that care should be taken to provide for it.

Such tools and machines as are here referred to should, therefore, be placed in the buildings and plant schedule of the department having initial charge of them, and only those tools which under the old steam regime would have been classified as loose be included in the schedule next mentioned.

Schedule of Loose Tools.—It is quite impossible to keep a record of these articles individually in the same manner and form as has been recommended for plant, or to so estimate the life of each separate article, each hammer and chisel, and base the depreciation on such life. There is no alternative but to adopt an average rate or rates. An endeavour may, however, be made to secure the nearest possible approach to accuracy by dividing the tools into several classes, after the manner already mentioned for machinery. In consequence, however, of the greater number of articles and issues, and the consequent variation in value each month, some little modification of the schedule there recommended is necessary. The accompanying form is based on one used by a large firm of electrical engineers, but presents, we venture to think, some features which are improvements on the original.

It will be seen that the depreciation on Class A is taken at 24 per cent per annum, but calculated monthly on the monthly balances, and that on Class B at 12 per cent per annum, calculated in the same way. The amount of depreciation on tools must be charged to the various shops exactly as the depreciation on plant and buildings, and for this purpose it is convenient to add a column for "loose tools" in the summary of interest and depreciation.

The classification of the tools and rate of depreciation must be fixed by an engineer, either the works manager

THE CLYDESDALE ENGINEERING CO., LIMITED.

SCHEDULE OF LOOSE TOOLS IN CHARGE OF FITTING
DEPARTMENT.

CLASS A.

Date.	No.	Particulars.	Price.	Amount.		
Jany.		Balance and Issues (to be detailed) ..		150	6	4
		Less Depreciation 2%.....		3	0	3
				147	6	1
Feby.		Issues (to be detailed).....		20	6	8
				167	12	9
		Less Depreciation 2%.....		3	4	3
				164	8	6
		And so on.				

THE CLYDESDALE ENGINEERING CO., LIMITED.

SCHEDULE OF LOOSE TOOLS IN CHARGE OF FITTING
DEPARTMENT.

CLASS B.

Date.	No.	Particulars.	Price.	Amount.		
Jany.		Balance and Issues (to be detailed) ..		200	0	0
		Less Depreciation 1%.....		2	0	0
				198	0	0
Feby.		Issues (to be detailed).....		37	10	0
				235	10	0
		Less Depreciation 1%.....		2	7	1
				233	2	11
		And so on.				

or draughtsman, of course under the direction of the general manager, and not by an accountant or storekeeper. The rate should be sufficient to cover any reasonable loss through tools being mislaid, or left behind on jobs outside the works, as well as through fair wear and tear. The loss through carelessness on outside work may be reduced if each man taking such tools out of the yard has a pass given him by his foreman or storekeeper, on the face of which each tool is entered, and is required to produce such pass on his return, with the tools he brings back, so that they may be checked with it. If the tools are issued from the workshop the pass should be issued by the foreman—they are tools in his charge—but if a stock is kept by the storekeeper for this purpose, the pass will be issued by him. In the latter case the stock of loose tools for temporary or separate use must be kept distinct from new tools in store, and the tools so issued by the storekeeper, as custodian of the whole stock, to himself as keeper of this stock in use, must be charged to a "Schedule of Loose Tools in charge of Stores Department," Class A, B, &c. The depreciation will come into the summary in the usual way under the title of stores department, and will be divided over the different working department in the same manner as other stores' general charges are apportioned.

The money balances in the schedules should show the value of loose tools on hand at stocktaking, theoretically, but it is quite certain they will never do so. If, however, the rates of depreciation have been carefully fixed, and full consideration has been given to all the facts of the case, any glaring discrepancy at stocktaking will demand explanation. Whether it arises from improper usage, or careless mislaying of tools, an excessive depreciation should be probed to the bottom, so that it may be remedied in future periods.

Goods en bloc.—The examples hitherto considered are of machines, or portions of machines, which in themselves are sufficiently large to be dealt with separately in the cost accounts. Many factories are, however, engaged upon productions which cannot possibly be dealt with individually; others make, in large quantities, portions of machines which, although they eventually appear in the accounts as part of the cost of many machines, cannot be conveniently dealt with individually at the time they are

manufactured. If, as an instance, we consider an ordinary loom, it is obvious that it would be impracticable to apportion the labour and material to each individual wheel in the loom, and to earmark the wheel from the moment work was commenced upon it, until it reached its final destination in the machine, and was delivered therein to the customer purchasing it. Such wheels are often made in hundreds, and the exact time and materials consumed on each cannot be defined without great and useless expense.

But it is necessary that the cost of manufacture should in some way or other be ascertained; indeed, it is apparent that the cost accounts cannot be completed unless provision is made for *all* work passing through the shops, and that must include work of this description. Nor is the difficulty insuperable. If a thousand change wheels have to be made they should be treated as one item; if a second thousand have to be made they should become a second item. In this way the cost of them *en bloc* may be ascertained, just as that of rivets, purchased at a fixed price per cwt., is ascertained from the invoice. Exactly the same method can be used for brass bolts or screws, or steel pins, or any of the thousand and one trifles which engineers make in quantities for their stores or warehouse. Of course the initial number per item need not be 1,000; it may even be varied for different classes of goods.

At the end of the month the 1,000 wheels will have cost a certain amount in labour and material, ascertainable from the ordinary records of wages sheets and stores issues. Of these, however, only 700 are completed, the remaining 300 are still in progress, although some work may have been done on them. So far as the cost accounts are concerned, and the ordinary books of the firm will follow the same method, there are two ways of dealing with the charges thus accruing to the end of the month. All the 1,000 wheels can be carried forward in the A sheet as stock in hand (work in progress) in the department, or the completed wheels may be charged to the stores account, leaving only the 300 incomplete ones to be carried forward as work in progress. The latter way requires enquiries on the part of the cost accountant; he cannot divide the cost in the proportions of 7 and 3, because more work has been done on the former than on the latter portion. The foreman in charge of the work must be consulted as to the proportions of work done on each

section, and as to the extent of labour required to complete the 300 unfinished wheels. Any discrepancy will be automatically adjusted the following month, it is true, but at the same time it is necessary that every possible precaution should be taken against discrepancies. In many cases it is preferable to adopt the second course, because the finished articles will be sent to the stores, and actually re-issued before the close of the month, and to retain them in the departmental stock would therefore give rise to complications.

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CHAPTER XIX.

GOODS MANUFACTURED FOR STORES AND WAREHOUSE. TRAVELLERS' AND SPECIAL EXPENSES.

Goods Manufactured for Stores.—The question arises how the foremen are to be instructed to manufacture goods for the stores department. Such work cannot be left to their own unaided initiation, nor can the storekeeper be permitted to issue his own requisitions direct to the technical officers.

We have seen that "a stores requisition book should be compiled from time to time by the storekeeper, and sent to the general office for the several orders to be made out under the authority of the manager." Among these requisitions will naturally be included demands for articles to be manufactured in the works. These articles may be distinguished by having an M, or other appointed letter, prefixed, either by the storekeeper for such articles as he knows are made in the works, or by the manager or his assistant for other goods they may determine shall be so made, when examining the book. The goods which are required from other manufacturers are entered on a list to be submitted for the approval of the directors; the M articles should also be included in a similar list for their sanction, so that they may have sufficient opportunity of checking any tendency to unduly increase the quantity of stores on hand.

Form of Order.—After the sanction of the directors has been obtained, or pending it in cases of emergency, orders must be issued to the executive of the works for the manufacture of stores materials, just as orders are issued to the vendors for stores purchased. The form adopted may simply be a modification of the ordinary order form, giving—

The number and date ;
Particulars and quantity of the materials required ;
The tests, if any, required ;
Date completion is wanted ;
Marks, if any, to be placed on the goods.

When this method is adopted, the order will be addressed and sent to the drawing office, and the usual shop order will be issued from there. In the cost accounts, both as regards materials and direct wages, and also establishment charges, precisely the same course must be followed with these orders for stores, as for those for a customer.

Alternative Form of Order.—There is, however, another form of order which may, in many works, be used to the saving of clerical labour, although it is not adapted to all. The form is as follows :—

THE CLYDESDALE ENGINEERING COMPANY, LIMITED.

Order for Goods for Stores.

Order No. Draughtsman.....

Particulars of goods to manufacture.....

.....

Quantity

Marks

.....General Manager.

	Shop Drawing No.		Shop Drawing No.		Shop Drawing No.
.....		
.....		
.....		
.....		
.....		
.....		
.....		

Patterns required

General remarks.....

.....

.....189... Chief Draughtsman.

These orders need not be of such large size as the ordinary shop order, as the various particulars required to be given in them will usually be very short; for instance, it will not be necessary to give many shop drawing numbers in an order of this kind for 1,000 screw bolts. Carbon copying books should be used, and by employing thin transfer sheets, which should be perforated at the binding edge, as many copies as necessary may be obtained by one use of the style. There should be a copy each for the drawing office, for the works manager, for the foreman concerned in the manufacture, for the pattern maker, and the storekeeper. The order will be prepared in the general office down to the signature of the general manager; one copy will be left in the book for future reference, and the rest will be pinned together, and sent to the drawing office. They will be completed, and distributed from there in exactly the same manner as ordinary shop orders. The drawing office copy should be pasted in a guard book kept for that purpose.

A separate series of numbers should be employed for these manufacturing orders, which numbers should be distinguished by a letter; it does not much matter which letter so long as it is not used for any other conflicting purpose, but it should be the same as that appointed for marking the requisition book.

Goods Manufactured for Warehouse. — Somewhat similar conditions to those last considered present themselves with respect to goods manufactured for the warehouse. By warehouse is meant the department in which finished materials are stored until such time as orders are received for them from some customer, or to which finished products are sent by the various departments, of the works for delivery to the customers ordering them, and for whom they were constructed. At present it is under the former aspect we are considering it.

Requisitions from Warehouse. — Some method must be devised by which the warehouseman may notify to the manager what machines and other goods he has in stock, and submit requisitions for the further supplies he requires. Here again arises the difficulty of suggesting a plan which may be equally suited for warehouses stocking only a limited number of articles, and those stocking a large number of diverse machines, and parts of, and appliances for, such machines. The information required by the

The date of requisition ;
Description of the machines or other articles required ;
Number or quantity now on hand, or on order, or
under construction ;
Additional number or quantity now required.

A column should be left for the manager's instructions, and another for the date of order to works or other vendors.

The articles approved for manufacture, or purchase, should be entered on lists to be submitted to the directors for sanction or confirmation, in precisely the same manner as those demanded by the storekeeper, so that they may exercise the same control over increase of stock in the warehouse as they do over that in the storerooms. In the case of the warehouse return, it is desirable to show the quantity of machines, &c., on hand of the description demanded; there is always a temptation to increase finished stock during times of depression, in order to keep the machinery moving. From a financial point of view, stock is capital (or borrowed money) locked up for the time being, whether the goods are in the stores, the warehouse, or in some departmental workshop.

Orders for Warehouse Goods.—It must be remembered that two orders are required in connection with warehouse goods. The first is for their manufacture; and the remarks in the foregoing paragraphs respecting goods for stores will apply equally to those for the warehouse. A separate series of numbers, distinguished by some letter not used for any similar purpose, must be employed, so that warehouse goods may be distinguished in all the records of the firm from those of the stores, and from customers' orders or contracts. Some of the articles kept in the warehouse for re-sale will be purchased from other manufacturers. In that case it will be found convenient to specifically mark on the counterfoil orders the word "warehouse," or some other intimation that the goods are intended for re-sale, and not for use on the premises.

The second order is an authority and instruction for the warehouseman to deliver certain machines or goods to some customer. A form for this has been given in dealing with drawing office orders (page 133), and it is unnecessary to add anything further.

Stocks in Stores and Warehouse.—It is necessary that the stocks in the stores and in the warehouse should

be kept absolutely distinct. There is a radical difference between them: the one is for use in the yard, generally for further labour to be employed on them; the other is for sale to customers. Under no circumstances must any issue be made direct from the warehouse to any working department in the yard. When any articles are required which are not in store, but are in the warehouse, they must be transferred from the latter to the former, and then dealt with as though they had been purchased originally for the purpose. The manner of dealing with these transfers will be considered later in connection with the ordinary commercial books.

It will be observed that a considerable number of the goods kept in the warehouse will be catalogue goods. The arrangement of the flooring space, shelves, and bins should be such as will suit the catalogue lists; that is, a milling machine must not be kept on one part of the floor, and the change wheels, chuck and key, extra bar and tube, and second swing frame, and screw keys, belonging to it dispersed up and down the place, or possibly in receptacles on another floor. Whenever it can be so arranged, each machine, with its "extras" complete, must be placed ready for packing and delivery, so that there may be no unnecessary loss of time in searching through the rooms when the order arrives. The warehouse is also frequently used as a show room, and this must be remembered in arranging it. "Window dressing" is not required in such a room, but orderly arrangement, and the placing of the goods in such position as will admit of convenient inspection, are absolutely essential.

Warehouse Book.—A stock book is as necessary for the warehouse as for the stores proper. The most effective plan is to keep received and issued books, and ledger (with machine, &c., titles) on the same plan as in the stores department, but without the money columns.

Charges to Warehouse.—There is a reason for omitting the money columns in the warehouse books, which does not apply to those kept in the stores. If the finished articles are debited to the warehouse at the cost of manufacture, the accounts will disclose to the warehouseman the profit made on them, as he will always be able to ascertain the selling price of most of them from the catalogues of the firm. On the other hand, if the debit is made at the selling price, there is danger of the warehouse stock appearing

in the books of the firm at its maximum value, and credit thus being taken for unrealised profits. A compromise may be made, by debiting the finished articles at assumed, and fixed prices, but this course is really open to both objections: it partially enlightens the warehouseman as to the profits made on them, whilst at the same time it does not wholly obviate the danger of over valuation.

But whether the warehouseman knows the debit prices or not, it is necessary, for the purpose of account keeping, that they should be fixed. Probably the better method is to adopt the compromise, and debit the warehouse at fixed prices, which should both allow a profit to the manufacturing department if prudently managed, and also to the selling department, regarded merely in its merchant capacity, but to make these entries in the general office books only. There does not appear, however, to be any fixed percentage by which these adjusted prices may be determined for all works; it must vary with the class of goods made and sold, and the following suggestions can only be offered for the consideration of the manager, whose own individual judgment must finally determine the matter.

1. Goods purchased from an outside manufacturer, for resale only, should be debited to the warehouse at the invoice price.

2. Goods manufactured in the works for sale stock should be debited to the warehouse *at the nett catalogue price, less —per cent discount*. This discount should be the same as the firm would allow to a selling agent who undertook all the trouble and cost of procuring orders, and delivering the goods to the purchasers.

3. This total amount of the discount thus allowed for the year should be sufficient to cover all the expenses of the warehouse, including travellers engaged in stock or catalogue goods, if it is to prove a remunerative portion of the firm's commercial transactions.

Warehouse Accounts.—An account should be opened in the general (financial ledger) of the firm, entitled "Warehouse Account." This must be debited with all articles purchased or manufactured for the warehouse, and, as there is no check by balance of money, the items so debited must be compared by the accountant, or one of his assistants, with the warehouse received book to see that quantities and descriptions agree. The invoices for

goods purchased on this account from other manufacturers must be checked by the warehouseman, and not by the storekeeper, and to this extent he will become acquainted with prices paid. But if it should be desirable to withhold any particular invoice from him it can be compared with his received book by one of the accountant's clerks, who will then make a remark on it to show that he has been satisfied of the receipt of the goods.

Articles delivered from warehouse stores must be credited to "Warehouse Account" from the day book. The day book for such deliveries should be entered up daily, either from the issue book or from a return of issues supplied by the warehouseman. There is not the same difficulty in obtaining this book for use in the general office for a portion of the day as there is in the case of the stores issue book, because there is not the same continuity of deliveries throughout the day in the warehouse as in the stores.

Similarly in the cost accounts an account must be opened for the warehouse department, which must be debited with purchases, with transfers from manufacturing shops and stores, and with proportion of establishment charges, in the same manner as fitters or blacksmiths would be. The C account will be credited with sales, the amounts being obtained from the day book, and will thus show the benefit which the merchant business of the firm is to it.

Travellers and Catalogues.—There are some difficulties in connection with the expenses for travellers, catalogues, and other forms of advertising. A consideration of these difficulties will show the necessity for the exercise of great skill in the apportionment of the charges. The difficulties and conditions vary in different factories, and the cost accountant must display his ability to apply general principles to specific cases.

So far as catalogues are concerned, it will generally be found that they are properly charges against the merchandise (warehouse) department solely. They refer to standard forms of machines and other goods, such as are usually stocked for sale; and although orders may frequently be obtained by means of them which require special manufacture, they would not have been secured had it not been for the existence of the standard types. The point, however, is one which requires watching.

Other forms of advertising introduce greater complications. As an instance, we will take the advertisement of Evan Campbell, engineer, of Southwell, which announces him as :

Maker to specification of heavy machine tools for stationary, locomotive, and marine engineers, boilermaker, millwright, artillerist, shipbuilder, &c. ;

And offers quotations for standard horizontal and vertical milling, boring, drilling, and planing machines, for lathes, and special water motors.

Now, it is evident that the first half of the advertisement is entirely for the promotion of the general business of the firm, and is intended to catch orders for constructions requiring special specifications and drawings quite as much as those for standard machines. The second, on the face of it, is an offer of catalogues or catalogue quotations, and has therefore special reference to goods stocked in the warehouse. The cost of such an advertisement should be divided into two parts, the first being debited to the general establishment account under which such charges are grouped, and the second being debited to the warehouse account.

The difficulty of adjusting travellers' salaries and expenses is still greater. We have already referred to the subject in treating of directors' travelling expenses. There is little doubt that a firm largely employing travellers will do so chiefly for the sale of standard types of productions, and if in their cost accounts a distinction is made between manufacturing and mercantile accounts, then the cost of the travellers should be charged to the latter. But this rule is subject to an exception. Some of the travellers may find a considerable portion of their time occupied in negotiations which bring no direct orders for stocked machines, nor even orders at all through the firm's peripatetic representatives, but result in inquiries which eventually secure large contracts for the firm. It is evident that this portion of the traveller's time and expenses is properly a charge against a specific contract ; that it should be extracted from the total payments to him, and charged to that contract ; and the balance only be debited against the warehouse.

For such analysis as this it is necessary that the cost accountant should be thoroughly trusted by his employers, and should have access to such records as reveal the expectations of the firm, as well as completed sales and

arrangements. A loyal man must be secured for the post, but a servant of such character having been obtained, it is idle to expect proper work from him if he is denied the necessary materials. It would be a repetition of the old story of the pyramidical brickmaking.

Limitation of Warehouse Transactions.—It must be remembered that there is a limit to warehouse sales, in procedure rather than quantity. Most manufacturers who stock goods in large varieties and quantities, either have acknowledged agents up and down the country, or deal with retailers. Such employment of middlemen forbids direct transactions with the public, except under such conditions as afford them no advantage over the selling price of the agent. As the agent or retailer usually obtains his profit through a discount allowed him off the list price at which he sells, any direct sales to the public should be at the latter price, without allowance of any discount. Even then the agent should be credited by the firm with his commission on the sale when it is to a person in his district. It is very easy to ruin a lucrative business of this character (in the absence of an absolute monopoly), by unfair dealing with the agents. Perfect loyalty to them is necessary in order to secure their best services, and best orders. The danger is not an imaginary one; it has been incurred, with disastrous results, in more than one instance which might be quoted.

There is another variation in internal method which may be mentioned, although it has perhaps suggested itself to the reader. The sale stock may be so limited in variety or quality as to render the employment of a warehouseman unnecessary, and the duties may be allotted to the storekeeper. In such case the warehouse books may be kept by him in the way already described; although he is only one man, he acts in a dual capacity. Or the articles, as manufactured, may be charged to the stores department at their selling price, a debit note being employed as a substitute for an invoice, and included in the stores issue return when delivered to any purchaser. This method, however, does not apportion profits between the manufacturing and selling departments, and can therefore only be usefully employed in those firms where sales from stock are of a strictly subordinate character.

Charges in Advance of Orders.—There is one portion of the expenditure of a firm on which considerable differ-

ence of opinion may arise, and which, indeed, requires treating somewhat differently in the cost accounts to the way adopted in the ordinary commercial books. It has already been incidentally referred to in dealing with the A cost account for management expenses, where the desirability of separating direct charges for special purposes is pointed out. The charges, however, which are now under consideration are not merely for a special purpose, but for a special purpose of which the benefit will not accrue until some future time.

In the case of an improvement in one of the specialities of a firm, as, for instance, a new or better form of pump or ram, devised by pump makers, the expense of placing it properly on the market will be very great. The advertisements and catalogues alone will probably exceed in cost the total amount of the first year's sales of the pump; indeed, it is quite possible they may do so for two or three years. In addition to these advertisements, it is possible that extra travellers may be employed, or, at least, that present travellers may be urged to greater exertions by payment of increased gratuities or allowances. It is hardly fair to debit such additional charges as these to the cost accounts of the year in which they are incurred, when the manufacture of the articles in paying quantities will only commence the next year. Such "extra-advertisement charges," inclusive of additional travellers, should be transferred from the initial A sheet to a B sheet, entitled "Additional advertisement expenses," or "New pump advertisement expenses," and a note made thereon of the term of years over which it is intended the charge should be spread. Great caution must be exercised in fixing this term: it should be sufficient to permit of a reasonable growth of business, if it is to grow at all, but not so long as to relieve the immediate period at the expense of production long after the new business has been, or should have been, established on a profitable scale.

So far as cost accounts are concerned, this appears to be a reasonable and correct method of dealing with charges of this kind. The object of these accounts is to ascertain the cost of manufacture, or other working, and not to furnish a basis for payment of dividends. But the trading account of the firm involves a different consideration, because on the result of it the directors of a limited company recommend the payment of dividends, or the individual proprietor or partners base their drawings.

The expenditure has been incurred; and no hopes or anticipations can bring the money back into the cash box or cancel the obligations if the bills are unpaid. Only very exceptional circumstances can justify the carrying forward of such items to a future profit and loss account. Each year's trading should display its own actual results, leaving anticipations to appear therein when they are realised. Of course, advertisements paid in advance may be carried forward exactly the same as insurances and taxes are, but this is merely an ordinary adjustment of account, and not a postponement of expenditure already incurred.

Charges in Advance on Foreign or Public Contracts.

Although the consideration of the subject of commercial management has been chiefly directed to mechanical engineering works, it will be readily seen that the suggestions made are also applicable to such larger constructive works as railways, docks, wharves, and public buildings, with some modifications which may be necessary to suit the special conditions of the country (when abroad), or to furnish additional information required by the head office at home. Any engineer or accountant accepting an appointment abroad, particularly in the Spanish-American countries, should remember that English manners and modes of working will not do there. Equal honesty, equal energy, equal determination to overcome obstacles are necessary, but the mailed hand must always be concealed by the silken glove. Nicolò Machiavelli is as desirable as Molesworth in the travelling bag for such a journey.

Foreign contracts of large proportions are seldom obtained without long negotiation, and the expenditure of a considerable sum on preliminary expenses. Officials, senators, governors, and even higher authorities have to be approached and conciliated, and the process is generally a costly one. And after the advantages to the country of the proposed works are admitted, surveys have to be made, plans prepared, and quantities and estimates got out, before the concession will be granted in legal form. So far as the accounts are concerned, these expenses must be considered under the two aspects of cost account, and of the commercial trade account and balance sheet. Whether they are summarised in England, or in the books of a branch house abroad, does not materially matter; the principles of treatment will be the same in either case.

It must be remembered that in cases of the kind in

question, especially when they involve large amounts or important contracts, the cost to the firm will be more than the salaries and expenses of the engineers, agents, and men employed abroad. The directors and manager will be using all their energies to carry through the contract, and will leave to the subordinate staff the duties connected with the ordinary routine of the establishment. A portion of the charges of the home officials must therefore be debited to the contract. So far as the A sheets are concerned, no difficulty can arise; it is merely a question of transfer, which must be determined by subsequent sheets. The B accounts will be opened for divisions of work, just in the same way as they would be if an actual concession had been granted and contract signed. For instance, the Toluco and Luis Potosi Railway are under negotiation and survey, and the following B accounts will be required.

1. Negotiation expenses, to include salaries of officials engaged on this work, and travelling expenses.
2. Negotiation commissions, to include payments to bankers, agents, and merchants assisting in the work, and also to Government officials, legislative representatives, and governors and presidents who require propitiating.
3. Survey.—Travelling expenses, for steamer and railway fares of staff proceeding on survey duty.
4. Survey.—Horses, saddlery, harness and carriages.
5. Survey.—Tents and other furniture.
6. Survey.—No. 1 section, No. 2 section, and so on; the salaries and other expenditure incurred for each section being apportioned to it separately.

These are only given as indications of accounts to be kept, and on many proposed undertakings it will be desirable to increase them. It will be seen that the first and second items are of such a nature that they cannot well be divided over the later ones, whilst the third is equally difficult to justly and fairly apportion, from the varying times at which the staff will be sent out, and the frequency with which some, at least, of them may be removed from one section to another. Horses and their fittings, and tents and furniture, have separate accounts allotted to them because the payments under those heads are for purchase of property, which will have some value

or other when the work is finished. The same objection exists to treating them as divisible charges as in travelling expenses: there is irregularity in their use both in time and distribution. On the other hand, all the cost of transporting such plant and materials, of their repairs, and of keep of horses, should be charged to the section of the survey on which they are for the time employed.

Eventually all such B sheets will be cleared by transfer, in the usual manner, to the C sheet for the contract, or for the sought for but unobtained concession.

Little difficulty, except in working out details, arises in the cost accounts, but a very real one exists when we turn to the ordinary commercial trade account. In treating of extra advertisement expenses for a new invention, or new development, the benefit of which may not be felt until a later period, it has already been said that only very exceptional circumstances can justify the carrying forward of such items to a future profit and loss account. Equal care is needful with these foreign concession expenses, and none of them should be carried forward to a future period without the special sanction of the directors, nor should such sanction be accorded without the most careful inquiry into, and consideration of, all the circumstances of the case.

Negotiation expenses, and negotiation commissions should undoubtedly be charged to the year in which the payment is made. The money has gone, for good or ill, and it will not in any case come back into the coffers of the firm. Whatever anticipations there may be of future profits on ordinary work arising from present exertions, no sound firm thinks of taking credit as a forward charge for any portion of the salaries or wages incurred in such exertions; the same safe rule should certainly be followed when the efforts have been employed to secure a foreign contract, or even a large home public contract, the ultimate result of which must always be exceedingly doubtful.

Survey travelling expenses should likewise be debited against the trade account of the year in which they are incurred.

Horses, harness, tents, and furniture, &c., should be reduced on the lines already given for depreciation accounts, and the amount of such depreciation debited to the trade account for the period, the balance being taken credit for as stock in hand.

The survey of sections presents the greatest difficulty, more especially as under this head the heaviest amounts will be involved. We have known instances where such expenditure has been sufficient to absorb, or even more than absorb, all the profits of the firm on their ordinary business, and place the result of a successful year's trading on the wrong side of the balance sheet. Shareholders very naturally would resent such a treatment of the matter as this, and would prefer a dividend with a small future risk to none at all with the risk removed. The question is one to be decided by each individual firm, but it should be decided after carefully weighing every factor affecting the case.

CHAPTER XX.

SALES IN COMMERCIAL BOOKS. REPORTS TO BOARD. DIAGRAMS.

Sales in Commercial Books.—We are now in a position to deal with the deliveries of the various articles to customers, whether in pursuance of a contract entered into, or order accepted, for work to be done in accordance with specified directions and requirements, or in pursuance of an order for stock or catalogue goods. There is no material difference, so far as the bookkeeping is concerned, and the questions of costs have already been disposed of.

Instructions to Warehouseman.—The warehouseman can have no difficulty in arranging for deliveries if he properly attends to his duties. Orders from stock are delivered in accordance with a special form of instruction issued from the general office, and sent through the drawing office for registration. This has to be returned to the general office, when delivery has been made. Orders or contracts for specially manufactured machines or other articles are supplied to him by means of the shop order form. Instructions as to mode of conveyance, address, or marking, insurance, and prepayment or forward freight, must be inserted on the warehouseman's copy of this document.

Delivery Book.—A delivery note must accompany all goods sent by the warehouseman to a customer. A very simple form will do for this purpose, and a carbon duplicate book is probably best for it. It is inconvenient and expensive to multiply copying presses throughout the yard, and on the other hand much time would be wasted by the man running to the general office to make a press copy every time he issued a delivery note. The form on page 273 will serve the purpose.

When the purchaser's works are in the same town as those of the manufacturer, the delivery note should be handed the carter to accompany the goods. When they have to be forwarded by rail, canal, or steamer, a consignment note, on the railway or canal company's form, must

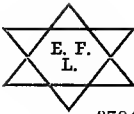
THE CLYDESDALE ENGINEERING CO. LTD.

Clydesdale Works,

Dumbarton,.....1899.

Delivered to Messrs. EVANS AND FOSTER,

Globe Engine Works, Lambeth, S.W.

No.	Description.	Marks.
1	Hydraulic Mandrel Press, No. 376.	

Per Caledonian Railway, for delivery at Globe Engine Works, Lambeth.

Carriage paid (or to pay).....

Packages.....

For the Clydesdale Engineering Co. Ltd.

.....

be made out, and this will accompany the goods on leaving the yard. A delivery note on the foregoing form must be made out at the same time, and sent into the general office, to be transmitted thence to the purchaser.

Marking Packages.—Special care must be taken to mark all packages in accordance with the purchaser's instructions, and not to let any name appear thereon contrary to his wish. This is occasionally a matter of supreme importance, particularly in the shipping trade. Merchants in London, Manchester, and Glasgow frequently order machines, &c., to be delivered to their order f.o.b., and require that no information should reach the ultimate consignee as to the origin of them. It is therefore imperative that no marks or names, beyond those furnished by themselves, shall appear on either machine or packing, and any neglect of their wishes in this respect will cause a rupture of the connection. The marking of the machines will affect the constructive departments, and they will act upon the instructions contained in the shop orders; the marking of the outer packages will be done by the warehouseman, and he must be equally careful that the instructions given him are complied with.

Some common sense must, of course, be employed by the warehouseman. For instance, one delivery may be comprised in twenty cases. The return must specify the exact contents of each case, as well as its mark, so that this information may be given on the invoice. All these details are not required in the drawing office, but they are occasionally useful, and time and labour is saved by using carbon copies in this way.

This return must be examined and verified by one of the accountant's clerks. The delivery book must be compared with both the warehouse issue book and the return. The cost accounts (C sheets) must also be checked with the returns for the month to ascertain that all completed orders have been entered therein. All this internal auditing may, to some, seem additional and unnecessary work, but the element of human fallibility must always be borne in mind, and no risk must be run of goods being delivered without being charged to the customer.

Invoices to Customers.—The first use to be made of the return received in the general office from the warehouse is to prepare an invoice for the customer. It is not absolutely necessary in all cases that this should be sent away the same day as the goods; the delivery note, if properly made out, is sufficient notice of the forwarding of the goods. No unnecessary delay should, however, be permitted, and in the case of goods for shipment abroad the invoice or invoices (for they have generally to be rendered in duplicate or triplicate), should be always sent off the day the goods leave. There is another instance where prompt preparation of invoices is essential, and that is the case of repairs of a steam or sailing vessel. The captain's signature, certifying to the details of the work executed, has to be obtained to the bill before the ship leaves the dock or river, and these details are often very prolix. In many shipyards it is usual to keep the bills written up as far as possible during the progress of the work, leaving only the time, stores, and closing items to be entered when the work is finished. When this is done, extra strong copying ink, which will copy after several days, must be used, if the invoices are written; if they are typed there will be no difficulty in obtaining presses after some little delay.

Copies of Invoices.—All invoices should be copied before they leave the office. A special book should be used for the purpose, and it must be kept indexed to date under

customers' names. In this book, as indeed in all others, perfect copies must be insisted upon. We have seen engineers' invoice copy books where some of the particulars of the work are unreadable, or the figures of the charges indistinct, or altogether wanting. Such carelessness as this must be sternly repressed by the accountant or other immediate head of the general office.

Day Book.—It is extremely inconvenient to post direct from the invoice copy book to the ledger, and even if this could be done, it would be necessary to prepare a summary for the nominal accounts, or else load them with individual entries. A day book should therefore be kept, which will form a convenient medium from which to post the personal debits, and at the same time provide a summary for the nominal entries. Two books may be used: one for specification orders, or contract sales, the other for warehouse orders and sales. A better plan, however, is to use a book with double cash columns, one for warehouse, and the other for specified sales. The entries may be very concise, as the following example will show, and no heading is necessary. A suitable book may be obtained at any commercial stationers.

		Warehouse.			General.		
		£	s.	d.	£	s.	d.
—— June 16 ——							
476	Donkin and Everitt—						
	1 8" standard lathe, No. 476, 1¼% in 3 months, copy B, 3/478.	110	0	0			
39	Adams and Jones—				"	"	"
	1 Crank axle to specification, 2½% in month, copy B, 3/479.				12	10	

If it is desired to make a further analysis of the sales, the right-hand pages of the book may be ruled for that purpose. This will entail a special book, but not necessarily special printing. The clerk who enters up the day book can easily head the columns as the work proceeds. It must, however, be observed that in this analysis, as in the columns of the left-hand page, a clear distinction must be maintained between general and warehouse sales.

As the debits to customers will be posted from this day book, and not from the copy book, it must be compared

with the original copies of invoices by a senior clerk of the accountant's department before any postings are made, and the auditor should also be required to check the two books, and see that they agree. Of course there is some little chance of errors being discovered through the payment of the accounts by customers, but this should not greatly be relied upon ; it opens the door to fraud.

The totals of the several columns must also be posted to the credit of the accounts concerned from the day book. If no analysis is made, the amount of the first column will be placed to the credit of warehouse sales, and that of the second to the credit of general sales. If an analysis is made the postings will be to the several accounts of such analysis. Thus, the right-hand page may be ruled with seven vertical cash columns, respectively headed :—

- W. Lathes.
- W. Machine Tools.
- W. Small Tools.
- W. Pumps.
- G. Gas Engines.
- G. Oil Engines.
- G. General Goods and Repairs.

The intention is that separate sale accounts shall be opened in the ledger for deliveries from warehouse stock of lathes, and so on ; and for general goods manufactured to specification or special order under the divisions of gas engines and so on. The sum of the first four columns must agree with the total of the warehouse column on the left-hand page, and the sum of the last three with the general column.

Monthly Statements.—It will be seen that, if his books are properly and closely posted up, the accountant has in his ledger debits to customers for all the invoices sent out. The terms of payment, when varying from the ordinary conditions of the market or firm, should be marked in the ledger. Thus, in the instances given in the day book, $2\frac{1}{2}$ per cent discount for payment in a month may be deemed the usual terms of the firm, and therefore no note is needed in the ledger. The $1\frac{1}{4}$ per cent discount in three months, however, is a special condition agreed to in order to secure an order against competing tenders, and the ledger entry should therefore be :

“ To Lathe, No. 476— $1\frac{1}{4}$ per cent, 3 months, £110 : 0 : 0

be ordered for the firm ; a list of the creditors and debtors, arranged so as to show the several dates when payments have to be made, or to be received ; and a summary result of the previous month's working, agreeing with those detailed cost accounts from which the most minute particulars can be gleaned when needed. Such returns will give the directors, or, in a private firm, the proprietors, considerable control over the business they supervise, and afford them sufficient warning of commercial mismanagement. It is necessary again to accentuate that returns, and accounts, and submission of requisitions, are not the most important matters for the directors to consider ; they are really only the preludes to the more difficult questions of wages rates, of economy of labour, of improvements in machinery, and of increase in output and sales, which are more especially the duties of the engineer than of the office. It is not the clerk, the careful compiler of returns, the neat and correct bookkeeper, who is all-important ; no doubt he has his place and value in the establishment, but it is a subordinate one ; the real determinator of profit and progress is the engineer, the administrator who takes the returns and accounts into his hands, and practically applies the lessons they contain. It is to the administrator, the scientist, the manager, and not to the mere accountant-monger, the directors must turn for advice and guidance.

Diagram Accounts.—The use of diagrams has become popular with engineers of late years. They have long been employed by actuaries and statisticians, and efforts have recently been made by several engineers to put them to increased use in cost accounts. An extremely able paper on the subject was last year read before the Institution of Mechanical Engineers by Mr. John Jameson, of Newcastle-on-Tyne, to which reference may be made with great advantage. The diagrams given with the paper are :

Fig. 1.—Machinery employment diagram.

Fig. 2.—Nine years' work.

Fig. 3.—Eight contracts in bad year.

Fig. 4.—Five periods of work.

Fig. 5.—Quarterly water consumption.

Fig. 6.—Thirty foundry orders.

The second of these diagrams exhibits in graphic form the result of the working of the establishment over a series of years. The corrected actual output is represented by

a fluctuating line, on which the percentage of charges is calculated, but which is reduced to a straight line, 100, for the purposes of the diagram. Percentage lines are then plotted out for wages, stores, issues, establishment, and machinery, which, when amalgamated in one line, furnish the total costs. The difference between this line of total costs and the line 100 of output shows the profit or loss each year. Again, the fifth diagram displays the rising percentage of wages to output in years when the output is falling—a fact which, in the second diagram, is supplemented by a corresponding rise in the percentage of establishment charges. When displayed in such form as this, the changes in trade results, arising from increase or decrease in money value of output, are brought very clearly before the management, and lead to the institution of inquiries into the causes of decreasing profits. They should, however, be prepared from, or in conjunction with, detailed cost accounts, and not substituted for them.

Diagram of Cost Accounts.—The cost accounts suggested in this treatise may be represented diagrammatically, but it will be found easier to do so in a series of diagrams than in one. The anterior section of the A sheets need not be thrown into diagram at all; they will appear under the several costs of the working departments in the proportions they bear to the direct wages paid therein, and this is the form in which they will be most useful to the manager. The second section of A sheets, those for moulders, blacksmiths, machinememen, fitters, &c., should be plotted out in separate diagrams, as shown in the page opposite.

This form is prepared by years, which will require a few ordinary additions of monthly charges to be made by the cost accountant. It may, however, be made out monthly, January, February, &c., being substituted for the years in the top line; but this will involve some trouble with adjustments, as will be seen on examining the items.

The "Output" entered on the first line should be the total output of the establishment at selling prices, and not the value of work done in the department as shown in the cost account. The line, "Total Costs," will therefore only afford a comparison between the amount expended in one department and that earned in all the departments. The remainder of the costs of production will appear in other like diagrams.

FILTERS.

[illegible]

The line, "Stores and Materials," will represent an amount obtained from the cost account, as under :

Stock, January 1st, so far as it represents actual material, and not work in progress	} £
Purchases	£
Transfers from stores department—that is, material drawn from there	} £
<hr/>	
Less—	
Materials returned, and stock on hand at December 31st (not being work in progress)	} £
	<hr/>
	£
	<hr/>

The several lines, management, drawing office, carriage and cartage, motive power, gas and water, and rents, rates, and taxes, will be obtained from the amounts appearing under those heads in the departmental cost accounts, both for materials and expenses, and salaries and wages. This is a little different to the form adopted by many engineers, but we think the departure is justified. In the form now suggested the line of stores and materials will represent those actually used in manufacture, leaving the stores for use in the offices and stables, and the fuel for running the machinery, to appear under the lines appropriated to those divisible charges.

Wages, depreciation, and interest will be lines obtained from the amounts appearing in the cost accounts. Both depreciation and interest are as truly part of the cost of manufacture as rent and gas are, and the latter line is so liable to fluctuation in firms labouring under certain financial conditions, that it should undoubtedly be graphically displayed in the costs diagrams.

Estimated charges must be brought into the calculations, but will not involve much trouble in an annual diagram. Estimated debits for goods received, but for which invoices have not been rendered to the firm at the time of stock-taking, must be added to the amount on which the line "Stores and Materials" is plotted out. If such estimated amounts are for any of the divisible charges, they must be added to the sum of such charges actually paid. On the other hand, estimated amounts for work in progress will be

added to the amount on which the line "Output" is based, and estimated stores on hand will be included in the amount deducted for stock in hand at December 31st. If the diagram is made out monthly, these estimations must be computed each month, and this necessarily causes some additional trouble.

The whole of these diagrams may be brought together in one "summary" sheet. The output will, of course, be the same as in the other diagrams, as it is the total output of the yard, but the several lines of costs will be the totals of the several departments.

There will seldom be any necessity to reduce the B sheets to the forms of diagrams. It can undoubtedly be done, but it is a question whether the minute lines, which would be involved in such drawings of comparison, would not be too fatiguing to the eye to be of any real service. They should extend over a considerable period, and cover a number of reproductions, in order to be useful, and such details are so numerous in large machine shops that very small sheets would have to be used for the purpose.

The C sheets will probably serve all the practical purposes of any B accounts when displayed in diagrams, and even with these it is a question whether it is desirable to so display them in all cases, or only in special or typical instances, which will be valuable for actual consultation. The form must be varied from that previously given, and although many others may be employed the following adaptation of some statistical forms will probably serve the purpose. The details are those previously used in the example of C cost account, but are only part of those needful for the actual slip.

The sterling divisions will vary according to the character of the contract: For a lathe they will be sufficient if arranged from £1 to £150, and can advance by pounds sterling; for a steamship they may reach to £20,000, or even more, and the advances may then be by £10 for the first £100, and by hundreds afterwards. Each of the sterling divisions of this example should, in practice, be subdivided into ten. A line drawn through the perpendicular divisions will indicate the amount of the contract, or the expenditure on the particular item named in the first column. These lines will be for the combined sums of wages and materials.

The engineer will have in such diagrams :—

1. The separate cost of the various manufacturing departments, both under the head of the total charge against the department, and also divided under the more salient items of expenditure.
2. The total of such expenditure throughout the yard, arranged in similar manner.
3. The contract price, and the cost, of any particular contract or order, which it may be desirable to represent in separate diagrammatic form.

More detailed information is obtainable from the cost sheets than from the diagrams, but, as the two should agree they can be used conjointly when necessary, and in mutual explanation of each other.

Technical Diagrams.—It is quite outside the scope of this treatise to deal with those diagrams which relate to the actual working of the factory ; which record the amount of work obtained from any machine, or form of machinery ; which contrast the various methods of transmuting energy into motion ; or which analyse the several modes of dragging out stored up energy, and rendering it the servant of man. But it is permissible to remind the reader that all such diagrams, though originally prepared for other purposes, may convey many lessons to the general manager for use in the commercial department. Loss or reduction of applied power is reduction of profit, and the manager in seeking for the cause of the one should bear in mind the effect on the other.

Custody of Diagrams.—As diagrams of the nature described are of a confidential character, and reveal much of the private working of the establishment, it is necessary to make the most careful arrangements for secrecy and safe custody.

CHAPTER XXI.

STOCKTAKING. BRANCH HOUSES. CUSTOMS AND SHIPPING REGULATIONS. RESERVE FUNDS.

Stocktaking.—The great opportunity for testing the accuracy of the account-keeping of a firm is the yearly or half-yearly stocktaking. Any important irregularities in the issue of stores, any careless bookkeeping, any deficient rates of depreciation, should then come to light, if the stocktaking and balancing are properly done. In many establishments, not only in engineering and allied trades, but in other manufacturing and merchant businesses, the work is unfortunately performed in a perfunctory and careless manner, and so the advantages obtained from it are not so great as they might be. The difficulties of a thorough stocktaking are undoubtedly great, unless the factory can be stopped for the purpose, but the benefits are sufficient to justify an effort for it.

The stock in the stores should be counted or weighed, as the case may require; nothing should be taken from the stores ledger as being the correct quantity. As each bin, case, or other receptacle is examined, the exact contents should be marked on a ticket, and attached to it. If the counting or weighing occurs some days before the actual date of stocktaking, or even early on that day, any variations through issues of materials should be marked on the ticket, so as to show the quantity still left in stock. When it is possible to so arrange it, this weighing and counting should be done by, or under the inspection of, some of the clerks of the general office, and not entrusted to the storekeeper's staff without supervision. They may be thoroughly honest and reliable, but it must be remembered that the object of stocktaking, as of all other forms of auditing, is to detect and remedy careless or fraudulent errors, and should not, therefore, be entrusted to the very men compromised by such errors.

The stock list should be taken down on the actual date of the balance sheet from these tickets on to sheets of foolscap. The sheets should be ruled for the following particulars :—

Quantity (weight or numbers).

Description.

Purchase price.

Present price or value.

Valuation at latter price.

The valuation should be worked out either by the storekeeper or the clerks in the general office, after the remaining portion of the sheets have been filled up, and carefully checked by a reliable clerk of the accountant's department. In all cases the bases of valuation should be fixed by the directors or general manager.

The stock in the warehouse should be obtained and valued in precisely the same manner. Much less difficulty will be experienced in dealing with this than with the store stock, since it does not consist of such a variety of articles, nor is it usually spread over so large a space, nor distributed into so great a number of receptacles.

The lists of both stores and warehouse stocks should be compared with the books kept in those offices. When they do not agree explanations must be asked, and if needful a scrutiny must be instituted.

The machinery, both fixed and removable, and the loose tools, must be taken down on similar sheets, room by room, and carefully compared with the schedules kept in the offices. Lathes, milling machines, and other similar machines, must each be completed, with a set of cutters and other tools belonging to it, before the stocktaking is attempted.

The machinery of the factory need not be valued every year if schedules, such as those already referred to, are properly kept. But such a valuation should be made at definite intervals, say each five years, in order to ensure that sufficient depreciation is being written off. Loose tools, alike from their own inherent tendency to waste, and the provocation they give to pilfering, should be carefully valued at each stocktaking, and the result compared with the schedules kept in the office. The difference between the two records should not be great if the books have been properly kept, and sufficient allowances, based on the experience of previous years, have been made.

All sheets should be initialled by every person who has been employed upon them, and a short note made of the work he has done : thus,

“Quantities taken,” D. S.

“Prices checked,” C. M. W.

“Calculations checked,” E. W. and C. M. W.

Branch Houses.—The system of management to be adopted for branch works must be determined by individual circumstances, and by the special qualifications of the officers controlling them. It will also be considerably modified where resident directors are appointed, or a local board of directors exists. In such cases it would obviously be improper, and indeed absurd, for the board at the head office to attempt the same minute supervision as it would when only an ordinary manager, skilful indeed as an engineer, but untrained in commercial arrangements, is appointed to the control of the branch. In all cases it is essential that a complete system of bookkeeping should exist, and that the stores issues, warehouse deliveries, wages arrangements, and cost accounts should follow the example of the head office. It will generally be found advantageous to complete the accounts of each branch as an independent concern, and so bring out a separate profit and loss account and balance sheet for it, which eventually may be incorporated with the head office accounts in a general balance sheet. There is no difficulty in doing this ; indeed, it is a plan already adopted by numerous firms in various trades.

Reports, returns, and statistics will be required by the central board and officers from the branches, but the nature and extent of these will necessarily be modified by the extent of the authority entrusted to the local officers, and will probably be changed from time to time, as the requirements and conditions of the business change. Although no general rules can, with any degree of wisdom, be laid down, some guidance for their formation may be gleaned from the examples of the great English and Scotch railway companies. The London and North-Western Railway Company, for instance, has a central board, with committees, at Euston, and a staff of accountants, auditors, and store-keepers, who there focus the accounts of the whole line. There is also a general manager, with a goods manager and superintendent of the line as his assistants, by whom all negotiations with foreign companies are conducted, and

the general polity of the railway directed. But in addition to these, district goods managers and district superintendents are appointed at the more important trade centres, so as to map out the whole extent of line between them. These district officers are entrusted with a very large amount of local authority; they carefully watch the working of each station and train within their own districts; maintain the discipline of the staff; suggest improvements in administration, and submit to Euston any recommendations which they think will tend to advance the interests of the company. The system is found to work admirably, but it is not the sudden and unaided initiation of any one man: it is a growth, a development during many years, passing through many changes during the period which has elapsed from its commencement, under Captain Mark Huish, to its perfection at the present day. This is the way in which branch establishment rules should be framed; it is perhaps more troublesome, but it will certainly be found more serviceable than the institution of cast-iron regulations "which altereth not."

Foreign Houses.—Whilst the same remarks apply in some degree to branch establishments in foreign countries, it must be remembered that it is necessary to grant the managers in such places considerable latitude with respect to details. The laws regulating commercial transactions are in some countries widely different to those of England, and insistence upon the English method of book-keeping would probably lead to the infliction of heavy penalties. We have known cases where auditors in England, and accountants of great eminence too, have sent instructions to Spanish-American countries in regard to accounts which, if complied with, would have subjected the officials there to fine and imprisonment. In these over-sea factories the proper plan is to select a faithful and efficient staff, and then very largely to trust them.

Foreign Cost Accounts.—There is no reason whatever why cost accounts should not be kept in any foreign country, provided the legal commercial account books are kept in addition. It is true they cannot usually be employed as legal evidence, but then that is not the primary object of keeping them; they can very well serve their purpose without being brought into court. When such cost sheets are kept, copies of them should be sent to the head office at home by the first mail after completion.

The directors, sitting quietly in their boardroom, will thus have a clear idea of the progress of the work and of its cost under their executive agents abroad. Regularity of transmission is, however, essential, and should be rigorously insisted upon.

Customs Regulations.—When any firm ships direct to foreign countries, and not through the medium of a merchant in England, it is absolutely essential that the customs regulations and tariffs of the country shipped to should be thoroughly understood. The tariffs are generally fairly well known, even to engineers who do not themselves ship goods direct, but the conditions under which those tariffs are administered are frequently unknown or neglected. These regulations and methods of computing and collecting the duties are of great importance, and any changes therein should be carefully observed. Information respecting them is published by the Government in the *London Gazette*, the *Board of Trade Journal*, and in Consular Reports.

Shipping Regulations.—Contracts entered into abroad involve shipments of goods, sometimes by regular lines of steamers, at others by ocean “tramps,” and occasionally by vessels specially chartered for the purpose. When the shipments are by regular lines, or even by tramps open for general cargo, the bill of lading usually forms the contract between the parties, both with respect to carriage and delivery of the goods, and payment of freight. In such cases little difficulty is likely to arise, as the construction of such documents is usually sufficiently known to merchants and manufacturers who are in the habit of shipping. But a ship is sometimes chartered by her owners to a broker or merchant, and put up by the charterer as a general ship; and in the bills of lading a reference is made to the charter party, and a stipulation for payment of “freight and other conditions as per charter party.” When this is done the shipper is bound by such of the provisions of the charter party as are referred to in the bill of lading. Again, when the ship is chartered by the shippers themselves, all the conditions of her user, of demurrage, and of payment of freight or hire, will be regulated, as between the owners and charterers, by the charter party, and not by the bills of lading issued. It is, therefore, important in all these latter cases that the charterers should have, at least, a general knowledge of the

obligations upon which they enter, and of the privileges they acquire.

An epitome of the law bearing upon this subject would occupy too great a space to be here incorporated, nor would it be satisfactory. Shipping law has monopolised the efforts of the greatest legal intellects in the world, and can only be properly explained by a writer trained by long experience to appreciate legal difficulties and distinctions. An excellent work on the subject is Maude and Pollock's "Compendium of the Law of Merchant Shipping," the fourth edition of which was edited by the Hon. Baron Pollock and Gainsford Bruce, Esq. Chapters VI. and VII. (each in two parts), on "Contract of Affreightment and its Incidents," and on "Insurance," will be found especially useful. The work is voluminous and expensive, but exceedingly valuable from the thorough and reliable manner in which every point of the subject is treated. Should a smaller or cheaper book be desired, a "Manual of Common Law," by Josiah W. Smith, B.C.L., Q.C., will be suitable. Chapters VIII. and IX., on "Shipowners and Charterers," and "Insurers and Insured," treat those subjects very ably.

Both the works are sufficiently lucid to be understood by a layman of average capacity, and warn him of the pitfalls which beset him in his capacity of charterer. The whole subject, however, bristles with difficulties, and the shipper should not attempt to grapple with them too deeply; payment of the lawyers' fees is usually the cheapest way in the end.

Reserve Funds.—Finally, it is necessary to consider the various conditions of those funds which are set apart, before division of profits, to meet future contingencies, and which are usually denominated "Reserve Funds." These are of three kinds:—

- (1) For equalisation of dividends, and reserve against general contingencies.
- (2) To meet depreciation in buildings.
- (3) To provide for replacement of machinery.

It must be remembered that we are dealing with engineering works, and that the consolidation of the three funds in one, after the general practice of banking or merchant houses, will be most unwise in firms which are so entirely dependent on the efficiency of their machinery for future prosperity. If only one reserve fund appears

on the balance sheet, the whole of it will be regarded by the shareholders as available for dividend in a meagre year, and the directors may possibly have great difficulty in defending it against encroachment.

The accumulation of this first reserve should be on the principle usually adopted in banks and merchant businesses; that is, by setting aside to it the difference between the amount available for dividend and the dividend actually declared. Thus, if £10,000 is the amount of nett profits in any one year, and an eight per cent dividend is declared, which will absorb £8,000, the balance of £2,000 should be placed to No. 1 reserve fund, instead of being carried forward into the next year's accounts, so as to then increase the amount for distribution. But there must be no mistake in building up this reserve. The £10,000 must be the balance which can be divided among the shareholders after making ample provision for reserve funds Nos. 2 and 3—that is, for depreciation and necessary replacements of buildings and machinery.

The fund is properly a dividend one; it is intended merely to help poor years, periods of bad trade, or strikes, and of adverse market conditions, with some of the money kept back in prosperous years; but it is not intended to meet any great or sudden emergency, to combat a financial crisis, or to conceal a disastrous loss. All bad debts, all losses on the year's trading, all reductions in values of stores must be written off this reserve fund when they constitute or create an adverse balance, and not carried forward in the profit and loss account to the following year to be made good out of the profits of that year. It is surely absurd to show a reserve of £5,000, brought intact from a previous account, in a year when a loss of £500 has been made on the trading, and to carry forward such loss to the following account on the assets side of the balance sheet. The reserve in such case is only £4,500, and should be so entered. It may seem a small thing to enter it the other way when the ultimate result is the same, but it is misleading to those shareholders who are not well versed in accounts, and care should be exercised to avoid anything which may give them a false impression. When the fund correctly represents an amount which is available for dividend purposes and ordinary contingencies only, it may very safely be used in the business of the company. It will probably earn more profit when thus employed than it would invested outside the business.

The second and third reserve funds differ from the first in this, that whilst the first reserve is built up out of surplus profits, the others should be debited to the trade account irrespective of the results it shows, and so set aside before any profits are calculated. The method of estimating depreciation by anticipated lives of buildings and machines has already been set forth, and the amount so arrived at should be the sums added to reserve funds Nos. 2 and 3 respectively. It is a usual practice with manufacturing firms to represent their building and machinery on the assets side of their balance sheets at decreasing values in manner following:—

Machinery as per last balance sheet.....	£88,456
<i>Less.</i> Depreciation at 5 per cent per annum	4,423
	<hr/> 84,033
<i>Add.</i> New machinery, purchased and erected	5,703
	<hr/> £89,736
	<hr/> <hr/>

This is correct, so far as it goes, since the machinery appears at a value which is supposed to be arrived at by a sufficient allowance for the wear and tear it has undergone. The amount to be written off should, however, be the total sum of the schedule of machinery already explained, and the entry on the balance sheet should be—

<i>Less.</i> Depreciation as per schedule transferred to reserve fund.	
No. 3 per contra	£4,423

The entry on the liability side of the balance sheet will then stand :

Reserve fund No. 3 (machinery), as per last balance sheet.....	£13,290
Transferred from profit and loss account...	4,423
	<hr/> £17,713
	<hr/> <hr/>

This will require a balancing entry, the nature of which will appear when the question of investment is considered.

Investment of Reserve Funds.—The method of dealing with these reserve funds is much more than a matter of bookkeeping; it is essentially a matter of commercial management, and although the manner we suggest may appear superlatively cautious, it only corresponds with that

adopted by prudent bankers. In limited companies it is certainly the proper course, especially when the increased and increasing responsibility of directors for the exercise of prudent management is considered.

To ensure security, to " earmark " the amounts as available only for a specific purpose, and to satisfy shareholders and investors that their capital expenditure could be restored to its original proportion by fresh purchases out of existent moneys at any time when necessary, it is desirable to invest the reserve funds in convenient securities outside the company's own business. Such investments should be in high-class securities, not liable to frequent or rapid fluctuations, and for which there is always a good stock exchange market. Consols, municipal loans, railway debentures, and preference stocks answer these conditions. Mortgages are usually good security when judiciously chosen, but there is the objection to them of not being readily turned into hard cash. They should therefore only be selected for the investment of the No. 2 (buildings) reserve fund, and to a limited extent for No. 3 fund.

The entry on the assets side of the balance sheet will then be :—

Mortgages on real property in Great Britain,) being investment of reserve fund No. 2 per) contra)	£3,710
Government and corporation securities, and) money on deposit at bankers, being invest-) ment of reserve fund No. 3 per contra)	£17,713

These recommendations may be old-fashioned, and seem to sacrifice the higher rate of interest which might be gained by throwing the money into the business in hotch-potch. The determination of the point must be left to the directorate, but we certainly consider the advantages of unquestioned and readily available security should decide it.

Recapitulation.—To resume the recapitulation from the termination of the cost accounts, we found that in order to ascertain that such accounts are correctly compiled, it is desirable to prepare from the commercial books a monthly profit and loss account, the result of which shall agree with the cost sheets. Certain other points demand attention, not so much from absolute necessity, as to facilitate the easy arrangement of work. Of these are the institution of

a works' instruction book, and the proper arrangement of shop-to-shop orders, so as to ensure continuity of order numbers and symbols. Claims against railway companies and other carriers are better kept in a separate claims book, a suitable form for which is a specially ruled ledger, which, however, is only to be considered a memorandum entry. Loose tools are a peculiarly difficult portion of the factory equipment to deal with, since the number of articles comprised in them, and the rapid rate of deterioration to which they are subject, render the fixing of any rate of depreciation difficult, and compel the adoption of an average one. Something may be done to increase the accuracy of the writing down by dividing the tools into classes, and giving an appropriate rate to each class. The manufacture of goods *en bloc* also requires some little adjustment of the ordinary way of apportioning wages and stores, so as to meet the special conditions of these wholesale orders. Goods manufactured for stores or warehouse should be undertaken only after official approval of requisitions for them, and in compliance with a works' order duly issued. This order may either be on the ordinary form of the company, or a special form, of which an example is given, may be more conveniently employed. In the warehouse it is desirable to keep received and issued books, and ledger, similar to those used in the stores department, and the requisitions from the warehouseman must show the quantity he has on hand of the particular goods demanded. Money debits and credits should be omitted from the warehouse books, to avoid any revelation of the profits made on catalogue and other goods: these money transactions should be dealt with in the general office by opening a warehouse account in the commercial ledger.

The next point is one of considerable importance, and frequently necessitates a divorcement in treatment between the general books of the firm and the cost accounts: it relates to the charges incurred in advance of orders both at home and abroad. The initial rule is that all expenditure should be debited to the period in which it is incurred, but there are exceptions to this in such cases as "extra-advertisement" charges for a speciality or improvement only just put on the market, and survey expenses in connection with a foreign concession, the legal formalities for which have not been completed. Such exceptions, however, shall only be allowed after most careful consideration

on the part of the directors: they affect the management and financing of the company or firm, and not its book-keeping only.

The instructions to the warehouseman for delivery of goods should be sufficiently explicit to enable him to properly mark and forward them. He must be provided with a delivery book, and must make out a note for each parcel of goods leaving the yard. Particular care must be exercised in marking the packages, so that the instructions of the purchasers on this point may not be violated. A return of all deliveries must be prepared by him for the drawing and general offices, and from this return the invoices to customers can be made out. Press copies of all these invoices should be taken, but for purposes of bookkeeping they must be entered into a day book ruled with double cash columns, for warehouse and general sales. The bookkeeping thus suggested will enable the accountant to submit to the directors, monthly, a list of debtors, with anticipated dates of payment, similar to that previously named for creditors; and he will also be in a position to supplement this by an approximate profit and loss account.

Diagrams have become popular of late years with engineers, and a very able exposition of the uses to which they can be applied in connection with accounts has recently been read before the Institution of Mechanical Engineers. The cost accounts suggested in the present treatise may also be represented diagrammatically, but it is not needful to so display all the divisions of them. Some of them are merely kept for collective and distributive purposes, and the results which are presented in ultimate sheets are those which are required by, and are most useful to, the engineer when thrown into diagrams. Two forms are suggested for this purpose: the first showing the results of departmental expenditure and charges, being equivalent to the later A sheets, and the second showing the total expenditure on completed contracts, or of such completed contracts as may from time to time be selected, either on account of their special importance, or because they are representative of classes of work or orders. Technical diagrams are outside the scope allotted to this treatise, but the reader is reminded that such diagrams, though originally prepared for other purposes, may convey many lessons to the manager for use in the commercial department.

The yearly or half-yearly stocktaking is pointed out as the great opportunity for testing the accuracy of the account-keeping of the firm, and also for detecting irregularities in the issue of stores, or deficient rates of depreciation. Suggestions are made for precautions to be taken in order to make the stocktaking really effective and approximately correct, and for fixing the responsibility for definite portions of the work on individual officers or clerks.

The arrangements desirable for the conduct of business in branch houses or works, or foreign houses, so far as they differ from the principal works regulations, are dwelt upon, and attention drawn to the difficulties involved in customs regulations and the intricacy of shipping laws. The question of reserve funds is entered upon, the various classes of them noted, and the appropriate forms of investment considered. The advantages of investing the reserves for replacement of buildings and machinery in securities outside the business of the firm, and which can be readily turned into hard cash, are deemed to be greater than the difference which might be gained in interest if they were employed in the firm's transactions, and thereby to a large extent locked up.

Conclusion.—It is only necessary to add that the words of this writing can serve no useful purpose unless they are aided by the intelligence of the reader. It is impossible to define any system, either of accountancy or management, which will equally benefit all establishments; there are local conditions of situation, capital, turnover, class of trade, and character and temper of officers and men, which render variations of method desirable, and even necessary. No text-book can, in such a complex question as management, do more than offer suggestions, and the value of the suggestions will depend chiefly on the manner in which they are applied by the reader. Engineers have greater difficulties to encounter in their purely technical work than those involved in commercial management, and there can, therefore, be little doubt of their ability to satisfactorily dispose of these business questions when once they set themselves down to master them.

INDEX.

	PAGE
Accountant, The	26-55
Accounts, Payment of	55
,, Collection of by Travellers	83
Advertising	79
Agents, Particular, Directors are	3
Alteration of Drawings	153
,, Special Contract Drawings	153
,, Standard Drawings	154
,, Patterns	155
Annual List of Members	12
Articles of Association	4
Attainment of Character	171
Auditor, Qualifications of	16
,, Preparation of Balance Sheet	17
,, Examination of Books and Accounts	17
,, Not Qualified for Management	17
,, Limits of Knowledge of Business	18
,, Summary of Duties	19
,, Monthly Audits	19
Audits, Monthly	19
Averaging Cost of Materials for Estimates	105
Balance Sheet, Preparation of	17
Blocks, &c., Allowance in Estimates	119
Boiler Specification	111
Branch Establishments	75, 288
Card System	35
Cartage	73
Cashier, The	26, 57
,, Selection of	58
Catalogues, Record of	34
,, Preparation and Circulation of	81
,, Cost of	264
Charges in Advance of Orders	266
,, ,, on Foreign or Public Contracts	268

	PAGE
Check Boxes, Time Checks	183
Cheques, Drawing of	61
,, Form of	61
Claims against Carriers	248
,, Form of Claims Book	249, 250
Commercial Management	1
Commissions, Illicit	35
Conclusion	297
Conferences	167
Contracts, Signing of	5
Correction of Invoices	46
Correspondent, The, Qualifications of	87
,, Authority of	88
,, Registration of Letters	88
,, Distribution of Letters	90
,, Departmental Letters	91
,, Telegrams Forwarded	92
,, The Typewriter	92
,, Lady Clerks	93
,, Register of Addresses	94
,, Printed Memorandums	94
,, Postal and Telegram Register	94
,, Filing Letters	95
Cost Accounts	67, 208
,, Nature of	70, 208
,, Division of	70
,, Invoice Debits to	71
,, Freight and Cartage	73
,, Use of in Estimates	116
,, Cost Sheet A	208
,, Management Expenses: Form A	209
,, Debits to ditto	210
,, Credits to ditto	212
,, Direct Charges for Special Purposes	213
,, Cartage, Coal, and other Establishment Charges..	214
,, Depreciation	215
,, Interest	220
,, Later Departmental Sheets	224
,, Transfers from Departments	226
,, Estimated Charges	227
,, Credit Transfers to Sheets	228
,, Materials and Expenses	228
,, Salaries and Wages	229
,, Sheet B	230
,, Scrap Material	232
,, C, or Contract Summary Sheet	232
,, Arrangement of Debits, C Sheet	233

	PAGE
Cost Accounts : Credits, C Sheet.....	233
,, Form of C Sheet	234, 235
,, Closing of C Account	236
,, Quantities in	237
,, Trade Debits and Credits	237, 238, 239
,, Transfers to Plant Sheets	240
,, Monthly Profit and Loss Account	245
Credit and Debit Notes	47
Creditors, Monthly List of	58
,, Sanction of Payment by Directors	60
Customs Regulations.....	290
Daily Reports by Travellers	84
Day Book	276
Debit and Credit Notes	47
Delivery Book.....	272
Delivery, Date of	35
,, Penalty Clause	36
Delivery Notes	42
Depreciation : Cost Accounts.....	215
,, by Individual Machines.....	218
Departmental Cost Sheets	224
Departmental Letters	91
Diagram Accounts.....	279
,, Cost Accounts	280
,, Technical.....	285
,, Custody of	285
Discipline, Necessity of.....	21
Discounts and Packages	48
Disputes as to Wages	194
Distribution of Letters	90
Directors	1
,, Duties and Responsibilities	2
,, Particular Agents	3
,, Payment of Dividends out of Revenue or Capital	4
,, Act as a Board	5
,, Signing of Documents or Contracts	5
,, Seal of the Company, Care and Use of.....	6
,, Rules for Meetings	7
,, Committees	9
,, Officers' Attendance at Boards and Committees	9
,, Attendance Book.....	10
,, Appointment of Officers	10
,, Resolutions, Reports on.....	14
,, Monthly Reports to	278
Dividends, Payment of, out of Revenue or Capital	4
Division of Sales.....	86

	PAGE
Documents, Signing of.....	5
Drawings, for Estimates	119
" Shop	140
" Registration of Drawings, and Register	143
" Numbers of... ..	144
" Alternative Plan of Register	148
" Shop Drawing Numbers	150
" Index to Drawings' Register.....	151
" Special Contract Drawings	152
" Alteration of Drawings	153
" Alteration of Standard Drawings	154
" Drawings for Works	156
" Preparation of Shop Drawings.....	156
" Separate	157
" Examination of Shop Drawings	157
" Shop Drawings' Diary	159
" Filing of	160
Drawing Office, Importance of	26
" Scientific Investigations in	27
" Requisitions	29
" Orders for Work.....	132
" Order Book	133
" Stock Orders.....	133
" Shop Orders and Lists, and Form of	138
" Parts to be Supplied from Stores, &c.	141
" Patterns Required and General Remarks	141
" Supplementary Shop Orders	142
" Shop Order Copy Book	143
" Preparation of Shop Drawings	156
" Examination of Drawings	157
" Return of Tracings and Prints	157
" Tracings Sent Away	159
" Filing Drawings	160
" Sketch Books, &c.	162
" Relations with Works Manager.....	163
Duties of Directors	2
" Secretary	11
" Auditor	19
" General Manager	20
Engineer, Qualifications of Manager as	24
Establishment Charges, for Estimates	105, 120
" Cost Accounts	214
Estimate Clerk	103
Estimated Charges, Cost Accounts	227
Estimates, Preparation of	98
" Catalogue	103

	PAGE
Estimates; Averaging Cost of Materials	105
,, Weight of Materials	105
,, Establishment Charges	105, 120
,, Profits on Standard Machines	106
,, Estimates in General	106
,, Data for	108
,, Order of	109
,, Labour and Materials	110
,, Quantities of Materials	110
,, Approximation from Former Constructions	110
,, Boiler Specification	111
,, Price of Materials	113
,, Unstable Equilibrium of Markets	113
,, Estimation of Labour	114
,, Estimation by Technical Experts	115
,, Cost Accounts, Use of, in Estimates	116
,, Steamship Estimate	117
,, Wages and Salaries, Division of	118
,, Drawings, &c.	119
,, Blocks, &c.	119
,, Profit	122
,, Estimates Sent to Customers (Tenders)	123
,, Tender Copy Book	124
,, Pursuing Tenders	124
,, Tender Index Book	124
,, Estimates and Commercial Records	126
Examination of Books and Accounts	17
,, Invoices for Materials Purchased	45
Factory Rules	164
Filing Letters	95
Foreign Contracts: Advance Charges	268
Foreign Houses	289
,, Cost Accounts	289
Foremen's Records	116
Foremen, Timekeeping of	180
Freight	73
General Manager (see Manager, The General).	
Goods <i>en bloc</i>	254
,, Manufactured for Stores	257
,, Form of Order	257
,, Alternative Form of Order	258
,, Manufactured for Warehouse	259
,, Requisitions from Warehouse	259
Incentives to Productive Energy	171

	PAGE
Incentives to Productive Energy: Profit Sharing	172
" " American Methods	173
" " Fixed Piecework Rates	174
" " Analytical Piecework Rates ..	175
" " Differential Piecework Rates..	177
Inspection of Materials in Progress.....	37
Instruction Book, Works	248
Interest : Cost Accounts.....	220
" Summary of.....	222
Interviews	24
Invoice Book	49
Invoicess for Materials Purchased.....	43
" Examination in Office	45
" Passing for Payment	45
" Correction of	46
" Posting of	51
" Not Rendered.....	54
" Debited to Cost Accounts	71
" to Customers	275
" Copies of	275
" Day Book.....	276
Issue of Stores and Materials	195
Justice, Capacity for	21
Lady Clerks	93
Letters, Registration of	88
" Distribution of	90
" Departmental.....	91
" Filing of	95
Loose Tools	249
" Electrically-driven	251
" Schedule of	252
Machine Details, Nomenclature of	98
Manager, The General	20
" Duties and Qualities of.....	20
" Capacity for Justice	21
" Necessity of Discipline.....	21
" Routine Duties	21
" Selection of Staff	22
" Selection of Office Staff	23
" Qualifications as Engineer	24
" Working to Time	24
" Interviews	24
Manager, The Works	163
" Relations with Drawing Office.....	163

	PAGE
Manager, The Works : Qualifications	164
" Workmen and Factory Rules.....	164
" Order Book	165
" Clerk	167
" Conferences	167
" Shop Appointments	168
" Workmen's Characters.....	169
" Attainment of Character.....	171
" Incentives to Productive Energy	171
" Profit Sharing... ..	172
" American Methods.....	173
" Fixed Piecework Rates.....	174
" Analytical Piecework Rates	175
" Differential Piecework Rates	177
" Automatic Grading of Men.....	178
" Contract System.....	179
Management, Auditor not Qualified for.....	17
Management Expenses, Cost Sheet A	209
" Debits to Account	210
" Credits to Account	212
" Direct Charges for Special Purposes.....	213
Market, The Cheapest	33
Materials Purchased, Inspection of in Progress	37
" Receipt of at Works	39
" Tests of	42
" Invoices for.....	43
" Returns and Rejections	47
" Debit and Credit Notes	47
" Packages and Discounts ..	48
" Issue of	195
" Removal of from Stores.....	196
" Collection of	197
Members, Annual List of	12
Memorandum of Association.....	4
Meetings, Directors, Rules for	7
" Officers' Attendance at	9
" Minutes of	13
Monthly Audits	19
Monthly List of Creditors	58
" Sanction by Directors of Payment.....	60
" Profit and Loss Account	245
" Statements for Customers.....	277
Name Plates.....	140
Nomenclature of Machine Details	98
Officers : Appointment by Directors	10

	PAGE
Office Staff, Selection of	23
„ Timekeeping of	180
Orders for Purchases.....	32
„ Placing of	33
„ with a Favoured Firm	33
„ Received	126
„ Received Register.....	127
„ for Work, Drawing Office	132
„ Shop Orders and Lists	138
 Packages, Marking of	 273
Passing of Stores Requisitions	30
„ Invoices for Payment	45
Patterns Required	141
„ Numbers of	145, 150
„ Register of	145
„ Alteration of	155
Payment of Absent Workmen	194
„ Accounts	55
„ Wages	193
Piecework Rates, Fixed	174
„ Analytical	175
„ Differential	177
„ are not Cost Accounts	178
„ Wages Record	190
Petty Cash	66
Penalty Clauses	36
Personal Solicitation.....	85
Placing of Orders	33
„ with a Favoured Firm	33
Plant Sheets: Transfers from Cost Accounts	240
Postal and Telegram Register	94
Price of Materials	113
Printing Ink, Copyable.....	32
Productive Energy, Incentives to	171
„ Profit Sharing	172
„ American Methods.....	173
„ Fixed Piecework Rates	174
„ Analytical Piecework Rates	175
„ Differential Piecework Rates	177
Profit and Loss Account, Monthly	245
Profits in Estimates. General.....	122
Profit Sharing.....	172
Profits on Standard Machines	106
Public Contracts, Advance Charges.....	268
Purchases and Sales	28
Purchases of Materials.....	32

	PAGE
Quantities in Cost Accounts	237
Quotations, by Standard Prices.....	96
Railway Companies, Claims against.....	248
Recapitulation.....	76, 129, 240, 294
Receipt of Materials at Works	39
,, by Storekeeper.....	40
Register of Addresses	94
,, Members.....	11
,, Letters.....	89
,, Orders Received	127
,, Drawings	143
,, Patterns	145
Register, Postal and Telegram	94
Register, Alternative Plan.....	148
Relative Transport Costs.....	196
Removal of Materials from Stores	196
Reserve Funds	291
,, for Equalising Dividends.....	292
,, for Depreciation of Buildings.....	293
,, for Replacement of Machinery	293
,, Investment of.....	293
Resolutions, Directors' Reports on	14
Responsibilities of Directors	2
Reputation of the Firm	86
Requisitions, Drawing Office.....	29
,, Storekeeper's.....	30
,, Passing of Stores Requisitions	30
Returns and Rejections of Materials Purchased.....	47
Rough Time Book	184
Sales Department	79
Sales and Purchases	28
Sales, Division of	86
,, in Commercial Books	272
,, Instructions to Warehouseman.....	272
,, Delivery Book.....	272
,, Marking Packages.....	273
,, Advice of Deliveries by Warehouseman	274
Scientific Investigations in Drawing Office	27
Scrap Material: Cost Accounts	232
Seal of the Company.....	6
Secretary and his Duties.....	11
Secretary: Register of Members	11
,, Annual List of Members	12
,, Minutes of Meetings	13
Shipping Regulations	290

	PAGE
Shop Drawings Diary	159
,, Drawing Numbers	150
Shop Drawings, Preparation of	156
,, Separate Drawings	157
,, Examination of Drawings	157
,, Return of Tracings and Prints	157
,, Temporary Sketches	157
Shop Orders and Lists, and Form of	138
Shop Orders : Parts to be Supplied from Stores, &c.....	141
,, Patterns Required and General Remarks	141
Shop to Shop Orders.....	248
Solicitation of Customers by Principals.....	85
Special Contract Drawings	152
Staff, Selection of	22
,, Appointments in Shops	168
Standard Prices, Quotations by	96
Steamship Estimate	117
Stock Orders	133
Stocktaking	286
Storekeeper's Requisitions	30
Storekeeper, Receipt of Materials	40
,, Qualifications and Selection of.....	41
,, Delivery Notes	42
Stores Ledger	52
,, Postings	202
Stores, Issue of	195
,, Issue Book	199
,, Prices of, for Issue	201
,, Return of Issues of.....	202
,, Postings to Stores Ledger.....	202
,, Postings to Financial Ledger	205
,, Expended Account	206
,, Goods Manufactured for	257
,, Form of Order for ditto.....	257
,, Alternative Form.....	258
,, Stocks in Stores and Warehouse.....	261
System, Value of	2
Subordinate Officials.....	26
Supplementary Shop Orders	142
Telegrams Forwarded	92
Temporary Establishments.....	75
,, Sketches.....	157
Tenders, Record of	34
,, Sent to Customers	123
,, Copy Book for	124
,, Pursuing Tenders	124

	PAGE
Tenders : Tender Index Books	125
Timekeeping	180
,, of Staff and Foremen	180
,, Admission of Workpeople ..	181
,, Time Checks	182
,, Check Boxes	183
,, Rough Time Book	184
,, Time Tickets.....	185
,, Wages Book	186
,, Abstract of Wages	188
,, Checking Wages Book	189
,, ,, Piecework	190
,, ,, Rates	192
,, ,, Time.....	192
Tools, Loose	249
,, Electrically-driven.....	251
,, Schedule of Loose.....	252
Tracings Sent Away.....	159
Trade Debits and Credits, Cost Accounts	237
Travellers, Employment and Character of.....	82
,, Collection of Accounts by Travellers.....	83
,, Daily Reports	84
,, Expenses of	264
Typewriting Machines	92
Unpaid Wages.....	195
Unstable Equilibrium of Markets.....	113
Value of System.....	2
Vouchers	65
Wages Book	186
,, Form of	187
,, Abstract of	188
,, Checking of	189
Wages and Salaries, Division for Estimates.....	118
Wages : Checking Rates	192
,, Checking Time	192
,, Payment of	193
,, Disputes as to	194
,, Payment of Absentees	194
,, Unpaid Wages	195
Warehouseman, Instructions to	272
,, Advice of Deliveries by	274
Warehouse, Goods Manufactured for.....	259
,, Requisitions from	259
,, Orders for Warehouse Goods.....	261

	PAGE
Warehouse : Stocks in Stores and Warehouse	261
,, Book	262
,, Charges to Warehouse	262
,, Accounts	263
,, Limitation of Transactions	266
Weights in Drawing Office Register	151
Weight of Materials for Estimates	105
Works Instruction Book.....	248
Workmen and Factory Rules.....	164
Workmen's Characters.....	169
,, Attainment of Character	171
Works Manager (see Manager, Works).	
Workpeople, Admission of..	181





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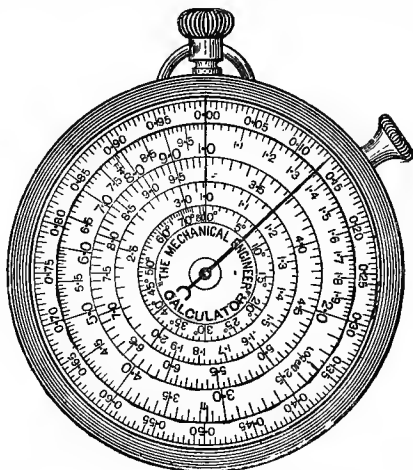
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